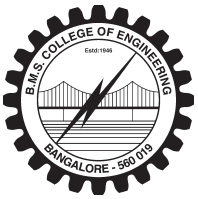

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು – 560 019

ಯೋಜನೆ ಮತ್ತು ಪಠ್ಯಕ್ರಮ

(2009–2013)

Scheme & Syllabus
(2009 - 2013)
CORE & CLUSTER ELECTIVES

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

Bull Temple Road, Bangalore - 560 019

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Department / Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester: III**

Subject Code	Subject Title	Credits				Contact hrs/wk	Marks		
		L	T	P	Total		CIE	SEE	Total
10MA3ICMAT	Engineering Mathematics-III	3	1	0	4	5	50	50	100
10ES3GCNAL	Network Analysis	4	0	0	4	4	50	50	100
10ES3GCAEC	Analog Electronic Circuits	4	0	1	5	6	50	50	100
09ES3GCDEC	Digital Electronics	4	0	1	5	6	50	50	100
09ES3GCFTH	Field Theory (EE/EC/TC/IT)	4	0	0	4	4	50	50	100
09ES3GCMST	Measurement Techniques (EE/IT/ML)	3	0	0	3	3	50	50	100
				Total	25	28			600

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Department / Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester:IV**

Subject Code	Subject Title	Credits				Contact hrs/wk	Marks		
		L	T	P	Total		CIE	SEE	Total
10MA4ICMAT	Engineering Mathematics-IV	3	1	0	4	5	50	50	100
09ES4GCLIC	Op-amps and Linear ICs	4	0	1	5	6	50	50	100
09ES4GCMPR	8086 Microprocessor (EE/EC/IT/TC)	3	0	1	4	5	50	50	100
09ES4GCSAS	Signals and Systems (EE/EC/IT/ML)	4	0	0	4	4	50	50	100
09ES4GCCST	Control Systems	4	0	0	4	4	50	50	100
09ES4GCHDL	Fundamentals of HDL	3	0	1	4	5	50	50	100
				Total	25	29			600

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Department / Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester:V**

Subject Code	Subject Title	Credits Hours /Week				Contact hrs/wk	Marks		
		L	T	P	Total		CIE	SEE	Total
10EE5DCTND	Transmission & Distribution	4	0	0	4	4	50	50	100
10EE5DCFDP	Fundamentals of Digital Signal Processing	3	1	0	4	5	50	50	100
10EE5DCTIM	Transformers & Induction Machines	4	0	1	5	6	50	50	100
10EE5DCEPG	Electrical Power Generation	3	0	0	3	3	50	50	100
10ES5GCMCS	Microcontrollers	3	0	1	4	5	50	50	100
10EE5DCMCL	Measurements and Controls Lab	0	0	1	1	2	25	25	50
10XX5GE1XX	Elective-I	4	0	0	4	4	50	50	100
				Total Credits	25	29			650

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Department / Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester: VI**

Subject Code	Subject Title	Credits Hours /Week				Contact hrs/wk	Marks		
		L	T	P	Total		CIE	SEE	Total
11EE6DCPSA	Power System Analysis	3	1	0	4	5	50	50	100
10EE6DCDSM	DC and Synchronous Machines	4	0	1	5	6	50	50	100
10EE6DCPEN	Power Electronics	4	0	1	5	6	50	50	100
10EE6DCMCT	Modern Control Theory	3	0	0	3	3	50	50	100
10XX6GE2XX	**Elective-II**	4	0	0	4	4	50	50	100
10XX6GE3XX	**Elective-III**	4	0	0	4	4	50	50	100
				Total Credits	25	28			600

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester: VII**

Cource Code	Course Name	Credits Hours /Week				Contact hrs/wk	Marks			Page No.
		L	T	P	Total		CIE	SEE	Total	
11EE7DCCTP	Computer Techniques in Power System Analysis	4	0	1	5	6	50	50	100	
11EE7DCSGP	Switchgear and Protection	4	0	1	5	6	50	50	100	
11XX7GE4XX	Elective IV	4	0	0	4	4	50	50	100	
11XX7GE5XX	Elective V	4	0	0	4	4	50	50	100	
11XX7IE1XX	Institutional Elective I	4	0	0	4	4	50	50	100	
11EE7ESPW1	Project	0	0	4	4	4	50	50	100	
				Total Credits	26	28			600	

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

Cluster: Electrical Sciences

Program: Electrical & Electronics **Semester: VIII**

Cource Code	Course Name	Credits Hours /Week				Contact hrs/wk	Marks			Page No.
		L	T	P	Total		CIE	SEE	Total	
11HS8GCIPR	Intellectual Property Rights	2	0	0	2	2	50	50	100	
11HS8GCPRM	Project Management	2	0	0	2	2	50	50	100	
11XX8IE2XX	Institutional Elective II	4	0	0	4	4	50	50	100	
11EE8DCSMR	Seminar	0	2	0	2	4	50	50	100	
11EE8ESPW2	Project	0	0	14	14	21	150	150	300	
				Total Credits	24	33			700	

L-Lecture Hours / week; **T**-Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE-Continuous Internal Evaluation; **SEE**-Semester End Examination (of 3 Hours duration)

Academic Year: 2012-2013

BMS COLLEGE OF ENGINEERING, BANGALORE
(Autonomous College under VTU)

Group I Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) Semester: V

Course Code	Course Title	Hours / Week			Credits	CIE	SEE	Total
		L	T	P				
10ES5GE1OP	Objected oriented programming using C++	4	0	0	4	50	50	100
10ES5GE1DD	Digital System Design using VHDL	4	0	0	4	50	50	100
10ML5GE1DS	Data Structures With C++	3	0	2	4	50	50	100
10ML5GE1BM	Biomechanics	4	0	0	4	50	50	100
10EE5GE1CS	Communication Systems (EE only)	4	0	0	4	50	50	100

GE- Group Elective L - Lecture Hours / week; T- Tutorial Lecture Hours / week; P-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; SEE- Semester End Examination (of 3 Hours duration)

BMS COLLEGE OF ENGINEERING, BANGALORE
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Group II Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) Semester: VI

Course Code	Course Title	Hours / Week			Credits	CIE	SEE	Total
		L	T	P				
10EE6GE2FV	Fundamentals of VLSI (EE only)	4	0	0	4	50	50	100
11EE6GE2HV	High Voltage Engineering	3	0	2	4	50	50	100
10EE6GE2UP	Utilization of Electrical Power	4	0	0	4	50	50	100
10TC6GE2OS	Operating Systems Concepts	4	0	0	4	50	50	100
10TC6GE2IP	Introduction to Image processing (Except ML)	3	0	2	4	50	50	100
10TC6GE2DA	DSP Algorithms & Architecture (Except EC, IT)	3	0	2	4	50	50	100
10ML6GE2SN	Bio Sensors	4	0	0	4	50	50	100
10ML6GE2BS	Bio Statistics	4	0	0	4	50	50	100
10EC6GE2MC	Advanced Microcontroller and Applications	3	0	2	4	50	50	100
10EC6GE2DA	DSP Architecture and Systems (Except TC, IT)	4	0	0	4	50	50	100
10IT6GE2MD	Biomedical DSP (Except ML)	3	0	2	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE
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Group III Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) Semester: VI

Course Code	Course Title	Hours / Week			Credits	CIE	SEE	Total
		L	T	P				
10EE6GE3ED	Embedded System Design (only EE and ML)	4	0	0	4	50	50	100
11EE6GE3MD	Electrical Machine Design and Drawing	3	0	2	4	50	50	100
10EE6GE3EI	Electronic Instrumentation (EE only)	4	0	0	4	50	50	100
10EE6GE3RE	Renewable Energy Resources	4	0	0	4	50	50	100
10TC6GE3RT	Real Time Embedded System (Except EC)	4	0	0	4	50	50	100
10TC6GE3SA	Introduction to Speech and Audio Processing	3	0	2	4	50	50	100
10TC6GE3MM	Design of Analog and Mixed mode VLSI circuits (Except EC)	4	0	0	4	50	50	100
10ML6GE3BC	Biomedical circuits with VLSI	4	0	0	4	50	50	100
10ML6GE3RE	Rehabilitation Engineering	4	0	0	4	50	50	100
10EC6GE3SP	Adaptive signal Processing	4	0	0	4	50	50	100
10EC6GE3IP	Image Processing Concepts (Except ML)	4	0	0	4	50	50	100
10IT6GE3RB	Robotics	4	0	0	4	50	50	100
10IT6GE3DP	Digital Image Processing (Except ML)	3	0	2	4	50	50	100

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Group IV Electrical Cluster Electives (Programs: EC/TC/IT/EE/ML) Semester: VII

Course Code	Course Title	Hours / Week			Credits	CIE	SEE	Total
		L	T	P				
11EE7GE4PS	Power Systems Operation and Control	4	0	0	4	50	50	100
11EE7GE4ID	Industrial Drives and Applications	4	0	0	4	50	50	100
11TC7GE4MC	Low power Microcontroller	3	0	2	4	50	50	100
11TC7GE4MM	Introduction to Multimedia Concepts	3	0	2	4	50	50	100
11TC7GE4SC	Satellite communication	4	0	0	4	50	50	100
11ML7GE4HM	Hospital Management Systems	4	0	0	4	50	50	100
11ML7GE4PC	Physiological Control Systems	4	0	0	4	50	50	100
11EC7GE4WC	Wireless communication (Except TC)	4	0	0	4	50	50	100
11EC7GE4ES	Embedded Systems Design	4	0	0	4	50	50	100
11IT7GE4DC	Distributed Computing	4	0	0	4	50	50	100
11IT7GE4MI	Medical Imaging Systems (Except ML)	4	0	0	4	50	50	100

Group V Electrical Cluster Electives(Programs: EC/TC/IT/EE/ML) Semester: VII

Course Code	Course Title	Hours / Week			Credits	CIE	SEE	Total
		L	T	P				
12EE7GE5PQ	Electrical Power Quality	4	0	0	4	50	50	100
11EE7GE5SP	Switch Mode Power Supplies	4	0	0	4	50	50	100
11TC7GE5EM	EMC -EMI	4	0	0	4	50	50	100
11TC7GE5SR	Software Defined Radio	4	0	0	4	50	50	100
11ES7GE5AD	ASIC Design	4	0	0	4	50	50	100
11ML7GE5IP	Advanced Medical Image Processing	4	0	0	4	50	50	100
11ML7GE5SP	Advanced Biomedical Digital Signal Processing	4	0	0	4	50	50	100
11EC7GE5LP	Low Power VLSI design	4	0	0	4	50	50	100
11EC7GE5NS	Network Security	4	0	0	4	50	50	100
11EC7GE5MM	Multimedia Communication	4	0	0	4	50	50	100
11IT7GE5ES	Embedded System and RTOS	4	0	0	4	50	50	100
11IT7GE5CN	Computer Communication Networks (Except TC)	4	0	0	4	50	50	100

BMS COLLEGE OF ENGINEERING, BANGALORE

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Summary categorization of Courses Offered

Department of Electrical & Electronics Engineering for Batch Admitted: 2009

Sem	HSS	BSC	ESC	PCC	PEC	IEC	Project	Seminar	Semester Total
I	02	09	13	-	-	-	-	-	**24**
II	04	09	13	-	-	-	-	-	**26**
III	-	08	-	17	-	-	-	-	**25**
IV	-	04	04	17	-	-	-	-	**25**
V	-	-	-	21	04	-	-	-	**25**
VI	-	-	-	17	08	-	-	-	**25**
VII	-	-	-	10	08	04	04	-	**26**
VIII	04	-	-	--	--	04	14	02	**24**
Course Total	**10**	**30**	**30**	**82**	**20**	**08**	**18**	**02**	**200**

HSS: Humanities
BSC: Basic Science Course
ESC: Engineering Science Course
PCC: Professional Core Course
PEC: Professional Elective Course
IEC: Institution Elective Course

BMS COLLEGE OF ENGINEERING, BANGALORE

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III SEMESTER ELECTRICAL CLUSTER

(For the students admitted during academic year 2009-10)

Subject	Engineering Mathematics - 3 (Common to all branches except for CS and IS)	Sub. Code	10MA3ICMAT
Credits	04	L-T-P	3-1-0

Objectives

The purpose of the course is to make the students well conversant with Fourier-Series, Fourier Transforms, formulate physical problems in terms of Partial Differential Equations, find insight into the physical behavior of systems from mathematical solution and develop computational skills using efficient numerical methods for problems in science and engineering.

UNIT I

Fourier Series:

Infinite series, convergence and divergence of infinite series of positive terms, power series, periodic function, Dirichlet's conditions, statement of Fourier Theorem, Fourier series of periodic function of period 2π and arbitrary period, half range Fourier series, complex form of Fourierseries, practical harmonic analysis. **(7L+2T)**

UNIT II

Fourier Transforms:

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms, Convolution theorem (statement only), Parseval's identities for Fourier transform. Fourier transforms of the derivatives of a function. **(7L+2T)**

UNIT III

Partial Differential Equations:

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $P\,p + Q\,q = R$ **(**Lagrange's partial differential equation). Method of separation of variables. **(5L+2T)**

Applications of Partial Differential Equations:

Derivation of one-dimensional heat equation, wave equation, various possible solutions of these by the method of separation of variables, D'Alembert's solution of wave equation. **(4L+1T)**

UNIT IV

Numerical Methods:

Finite Differences and interpolation: Forward differences, backward differences. Interpolation: Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Newton's general interpolation formula, Lagrange's interpolation

formula, Lagrange's inverse interpolation. Numerical differentiation: Numerical differentiation using Newton-Gregory forward and backward interpolation formula **(4L+2T)**

Numerical integration**:** Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule. Solution of algebraic and transcendental equations: Ramanujan's method, Newton-Raphson method, deductions. Numerical solution of ordinary differential equations: Euler's modified method, Runge-Kutta method of fourth order. **(4L+1T)**

UNIT V

Z –Transforms :

Definition, Properties, Transforms of standard functions, Inverse transforms.

Applications of Z –Transforms:

Solution of difference equations using Z-transforms. **(4L+2T)**

Calculus of Variations:

Variation of function and functional, Euler's equation, variational problems.

Applications of Calculus of Variations:

Geodesics, minimal surface of revolution, hanging chain, Brachistochrone problem. **(4L+1T)**

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, 40th Edn., Khanna Publishers
2. Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edn,. John Wiley & Sons
3. Introductory methods of Numerical Analysis by S. S. Sastry, 3rd edition, 1999, Prentice-Hall of India.

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

Subject	NETWORK ANALYSIS	Sub. Code	10ES3GCNAL
Credits	04	L-T-P	4-0-0

Objectives: This is a basic course which aims at absorbing the fundamental concept of circuit theory. It involves analysis of steady state and transient response of different networks excited by different sources.A strong background of this course will form a sort of a backbone to other related courses.

Loop Current, Node Voltage Techniques:

To review the fundamental concepts of circuit theory which are based on physical laws, develop network equations based on these laws and solve them by applying mathematical techniques.

Network Theorems:

To analyze networks for the evaluation of parameters and electrical quantities by applying theorems.

Laplace Transform:

To determine the steady state and transient response of electrical networks using the transform approach.

UNIT I **[08 hours]**

Basic Concepts:
Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh

UNIT II **[10 hours]**

(a) Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set & cut-set schedules, Formulation of equilibrium equations, Principle of duality.

(b) Resonant Circuits: Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth

UNIT III **[12 hours]**

Network Theorems :
Superposition, Reciprocity, Millman'sThevinin's and Norton's theorems; Maximum Power transfer theorem.

UNIT IV **[12 hours]**

Transient behavior and initial conditions
Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits Laplace Transformation & Applications

Review of Laplace transforms, waveform Synthesis, initial and final value theorems, step, ramp and impulse responses,convolution theorem, solution of simple R-L,R-C,R-L-C networks for AC and DC excitations using Laplace transforms.

UNIT V **[10 hours]**

Two port network parameters and State Variable analysis:

Definition of z, y, h and transmission parameters, modeling with these parameters, and relationship between parameters sets. Writing State equations and solution using Laplace transforms.

TEXT BOOKS:

1. "Network Analysis", M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. "Networks and systems", Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.
3. Theory and Problems of Electric Circuits (Schaum Series), 2nd Edition McGraw Hill

REFERENCE BOOKS:

1. "Engineering Circuit Analysis", Hayt, Kemmerly and Durbin,TMH 6th Edition, 2002
2. "Network analysis and Synthesis", Franklin F. Kuo, Wiley
3. "Analysis of Linear Systems", David K. Cheng, Narosa Publishing House, 11th reprint, 2002
4. "Circuits", Bruce Carlson, Thomson Learning, 2000. Reprint 2002

Subject	Analog Electronic Circuits	Sub. Code	10ES3GCAEC
Credits	05	L-T-P	4-0-1

Objectives:

- To understand basic semiconductor device physics and circuit analysis of the p-n junction diode and also getting into the design of practical applications of p-n diode.
- Get some *practical* knowledge about the design and analysis of basic analogcircuits.
- Understanding of basic semiconductor device physics and circuit analysis of BJT transistor and MOSFET.
- Ability to perform both formal DC circuit analysis and small / large signal mid-band frequency AC circuit analysis by model representation.
- Ability to perform circuit design and analysis, operating at mid-band frequencies.

- Ability to perform the detailed design and analysis of the discreet BJT Common Emitter Amplifier operating at mid-band frequencies.
- To Learn frequency response analysis and understand Bode Plots. Ability to perform the detailed design and analysis of the discreet BJT Common Emitter Amplifier operating at low and high frequency range.
- Analysis and Design of Feedback Amplifiers.
- Ability to analyze JFET and MOSFET analog devices including Common Source, Common Base and Common Collector Configurations.
- Ability to simulate electronic circuits using PSPICE.

UNIT I **[10 hours]**

Semiconductor Diodes – Semiconductor diode, ideal versus practical, resistance levels, diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode specification sheets, semiconductor diode notation, diode testing.

Diode Applications – Introduction, load – line analysis, series diode configurations, parallel and series –parallel configurations, AND/OR gates, clippers, clampers, voltage multipliers.

UNIT II **[12 hours]**

DC biasing of BJTS – Introduction, operating point, fixed bias circuit, emitter bias, voltage divider bias, dc bias with voltage feedback, miscellaneous bias configurations, design operations, transistor switching networks, troubleshooting techniques, PNP transistors, bias stabilization.

BJT AC Analysis – Introduction, amplification in the ac domain, BJT transistor modeling, r_e transistor model, the hybrid equivalent model, CE fixed bias, voltage divider bias, CE emitter bias, Determining the current gain, Effect of R_L and R_S, two-port system approach, summary tables, complete hybrid equivalent model , problems on h parameters(only CE configuration)

UNIT III **[10 hours]**

Power amplifiers – Introduction – definitions and amplifier types, series fed class A amplifier, transformer coupled class A amplifier, class B amplifier operation, class B amplifier circuits. Amplifier distortion, Power transistor heat sink, class C and class D amplifiers. Cascaded systems, Darlington connections.

UNIT IV **[10 hours]**

Feedback and Oscillator Circuits (BJT version only)– Feedback concepts, feedback connection types, practical feedback circuits, feedback amplifier – phase and frequency considerations, oscillator operation, phase shift oscillator, Wein bridge oscillator, tuned oscillator circuit, crystal oscillator, unijunction oscillator.

UNIT V **[10 hours]**

BJT frequency response – Introduction, logarithms, decibels, general frequency considerations, low frequency analysis – bode plot, BJT low frequency response, miller effect capacitance, BJT high frequency response.

FETs – Introduction, construction and characteristics of JFETs, transfer characteristics, important relationships, Depletion and Enhancement type MOSFETS.

Lab Experiments:- Clipping, clamping, half wave and full wave rectifiers, RC coupled amplifiers, Darlington emitter follower, RC phase shift oscillator, crystal oscillator, Hartley and Colpitts oscillator, voltage series feedback amplifier, Simulation experiments using Multisim/P-Spice.

TEXT BOOK:

Electronic Devices and Circuit Theory - Robert L.Boylestad and Louis Nashelsky - 9th edition - Pearson

REFERENCE BOOKS:

1. Integrated Electronics - Jacob Millman and Christos C. Halkias - TMH
2. Electronic Devices and Circuits - David A. Bell - PHI 4th edition

Subject	Digital Electronics	Sub. Code	09ES3GCDEC
Credits	05	L-T-P	4-0-1

Objectives

- The Knowledge of Digital Electronics as a Cluster core subject is to provide material fundamental to the design and analysis of digital systems.
- To provide various methods and techniques suitable for a variety of digital system design applications.

Introduction

To introduce the generation of switching equations from map and tabulation methods for simplifying Boolean functions.

Combinational Logic Circuits :

To Introduce the systematic procedure for Design and analysis of combinational circuits such as adders, code converters ,multiplexers etc..,.

Flip-Flops and Simple Flip –Flops Applications:

To Introduce the concept of sequential logic circuits by presenting various types of flip flops (with different types of triggerings). Covenient tools to analyse the sequential circuits are presented

Sequential Logic Circuits:

To Introduce a variety of sequential circuits such as registers,shift registers, counters(synchronous/asynchronous). and their design.

Synchronous Sequential circuits:

To Present various types of Synchronous Sequential Circuits ,their structure ,and design

UNIT I **[11 hours]**

Introduction :

Review of Boolean algebra, logic gates.Simplification of Boolean functions : The Map Method, Two and Three Variable Maps, Four Variable Map, Five and Six variable Maps, Product of sums simplification, NAND and NOR implementation, Other Two level implementations, Don't care conditions, The Tabulation Method, Determination of Prime Implicants, Selection of prime implicants, Concluding Remarks

UNIT II **[11 hours]**

Combinational Logic Circuits*:* Introduction,DesignProcedure,Adders, Subtractors, Code conversion, Combinational Logic with MSI and LSI: Introduction, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Multiplexers, Programmable Logic Devices, Programmable Read Only memories(PROMs), Programmable Logic Arrays(PLAs), Programmable array logic (PAL).

UNIT III **[10 hours]**

Flip-Flops and Simple Flip –Flops Applications*:* The Basic Bistable Element, Latches, Timing Considerations, Master Slave Flip-Flops(pulse-Triggered Flip-flops), Edge Triggered Flip Flops, Characteristic Equations.

UNIT IV **[09 hours]**

Sequential Logic Circuits*:*Registers, Counters, Design of Synchronous Counters

UNIT V **[11 hours]**

Synchronous Sequential circuits: Structure and Operation of Clocked Synchronous sequential Networks, Analysis of clocked synchronous sequential networks, Modeling clocked synchronous sequential network behavior, state table reduction, The state assignment, Completing the design of clocked synchronous sequential networks.

LAB experiments: – Verification of gates, implementation using basic gates and universalgates, Code conversion (Binary to gray, BCD to Excess 3), verify adders, subtracters, multiplexers, demultiplexers, comparators & code converter, verification of Flip flops, counters, shift registers

TEXT BOOKS:

1. Digital logic and computer design- Morris Mano, Prentice Hall
2. Digital Principles and Design- DonaldGivone, Tata McGraw Hill

REFERENCE BOOKS:

1. Fundamental of Logic Design- Charles Roth Jr., Thomas Learning
2. Digital Logic Applications and principles- John Yarbrough, Pearson Education

Subject	FIELD THEORY	Sub. Code	09ES3GCFTH
Credits	04	L-T-P	4-0-0

Objectives

Electromagnetic theory deals with the electric and magnetic fields produced by electric charges and currents, respectively, as well as the interaction forces between such objects. The demonstration that electric and magnetic forces are actually part of the same unified electromagnetic force led to the development of Maxwell's equations and the realization that light is in fact an electromagnetic wave. The theory of electromagnetism is perhaps the most successful theory of all time, and remains essentially unchanged even with the advent of quantum physics. We will develop the fundamentals of electromagnetic theory by studying individually static electric fields, static magnetic fields and time varying filed.

The overall objectives of each topic are:

- Coulomb's Law, Electric Field Intensity (EFI) & Electric Flux Density (EFD):
  - To review basic concepts of vector analysis
  - To discuss about the Coulomb's Law
  - To derive equation for EFI, and EFI due to Line Charge, Surface and Volume Charge.
  - To explain the Gauss' Law and Gauss' Law applied to differential elements (Divergence theorem).
  - To derive expression for Electric Flux Density and also discuss the Gauss' Law, Application.
- Energy and Potential & Current and current density:
  - To discuss about Energy spent in moving charge,
  - To derive expression for PD and PD due to Point Charge & System of Charge.
  - To develop equation forCurrent, Continuity of Current, Current Density, Energy Density and Boundary Conditions.
  - To explain the Properties of Conductor.
- Dielectric and capacitance &Poisson's and Laplace's equations:
  - To develop equation for capacitance of different configuration.
  - To derive the expression for Poisson's and Laplace's Equations &solution of Poisson's & Laplace's for Single Variables.
- Steady Magnetic Field:
  - To obtain expression for Biot-Savart Law and its application
  - To explain the Ampere's circuital law and Ampere's circuital Law applied to differential elements (Curl)

- To build the relation of Magnetic Flux and Flux Density,
- To recognize the significance of Scalar and Vector Magnetic Potentials.

- Magnetic forces and Inductance & Time varying fields and Maxwell's equations:
  - To derive equation for Force on a moving charge and Force on different current element.
  - To develop equation for Inductance and Mutual Inductance and Magnetic Boundary Condition.
  - To derive the expression for Faraday's Law and Displacement Current.
  - To develop equation for Maxwell's Equations in Point and Integral Form.
  - To derive the Uniform plane waves, Wave equations and solution of wave equation.
  - To discuss the Wave propagation through good dielectric, good conductor, skin depth.
  - To obtain expression forPoynting Theorem.

UNIT I

Coulomb's Law, Electric Field Intensity (EFI):-Experimental Law, EFI due to Line Charge , Surface and Volume Charge.

Electric Flux Density (EFD), Gauss' Law, Divergence:-Electric Flux Density, Gauss' Law, Application, Divergence and Divergence Theorem. **10 Hrs**

UNIT II

Energy and Potential: - Energy spent in moving charge, Definition of Potential Difference (PD), PD due to Point Charge and System of Charge, Energy Density

Current and current density: -Current and Current Density, Continuity of Current, Conductor, Properties, and Boundary Conditions.- **10Hrs**

UNIT III

Dielectric and capacitance:-Dielectric materials, boundary conditions, capacitance of different configuration.

Poisson's and Laplace's equations:- Derivations of Poisson's and Laplace's Equations, solution of Poisson's and Laplace's for Single Variables. **10Hrs**

UNIT V

Steady Magnetic Field:-Biot-Savart Law, Ampere's circuital law, curl, Magnetic Flux, Flux Density, Scalar and Vector Magnetic Potentials. **10 Hrs**

UNIT V

Magnetic forces and Inductance:-Force on a moving charge, Force on different current element, Magnetic Boundary Condition, Inductance and Mutual Inductance.

Time varying fields and Maxwell's equations:-Faraday's Law, Displacement Current, Maxwell's Equations in Point and Integral Form, Uniform plane waves, Wave equations,

solution of wave equation, wave propagation through good dielectric, good conductor, skin depth, Poynting Theorem. **12Hrs**

Text Book:

1. **Engineering Electromagnetics,** William J Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th Edition, 2006.

Reference books:

1. **Electromagnetics with Applications,** John Krauss and Daniel A Fleisch, McGraw-Hill, 5th Edition, 1999.

Subject	MEASUREMENT TECHNIQUES (EE/IT/ML only)	Sub. Code	09ES3GCMST
Credits	03	L-T-P	3-0-0

Objectives

This Course aims at educating UG students about electronic measuring instruments & basic Principles of measurement, starting with an introduction to measurement errors, construction & Working of PMMC meter, range extension methods,followed by study of digital instruments. There is a discussion on measurement of resistance, inductance & capacitance using bridges. The course exhaustively deals with transducers. Recording& display deviceswere briefly discussed.

Fundamentals of measurement & Electrical measuring instruments

To study the performance characteristics of an instrument.

To classify the three major categories of error of a instrument.

To explain the construction & working of PMMC instrument.

To know how to convert a galvanometer into an ammeter or a voltmeter having desired range

How to use a universal shunt to extend current ranges

Electronic measuring instruments

To list the advantages of a electronic measuring instrument over an analog meter.

To appreciate the basic block diagram description of digital instruments.

To Design the instrument to measure some electrical properties of coils & capacitors using Q-meters.

Measurement of Resistance, Inductance & Capacitance

Measurement of resistance,inductance,capacitance using Bridge methods.

Transducers, Display devices & Recorders

To distinguish the functions of a transducer, principle&working of displacement transducers, temperature sensors, photo sensitive devices.

To recognize the usage of graphical recorders& display devices.

To Measure electrical quantities using C.R.O.

UNIT I **[7 hours]**

Fundamentals of Measurement

Introduction, Static Characteristics, Dynamic Characteristics, Errors in measurement, Types of errors, Sources of error. *Electrical Measuring Instruments:*Types of Instruments, Principle of Operation, Constructional features of PMMC instrument, shunts & multipliers, universal shunt, multi range voltmeters.

UNIT II **[08 hours]**

Electronic Measuring Instruments:

Need for electronic measuring instruments, True RMS responding voltmeter, Digital voltmeters- Ramp Type, Integrating Type, Successive Approximation Type, Q meter, Digital Multimeter - Block Diagram description.

UNIT III **[08 hours]**

Measurement of Resistance, Inductance & Capacitance:

Wheatstone's Bridge- Sensitivity analysis, Limitations, Kelvin's Double Bridge, Maxwells Bridge, Schering Bridge, sources & Detectors, Minimization of AC Bridge Errors, Problems.

UNIT IV **[08 hours]**

Transducers-I:

Classification & Selection, Principle of operation of Thermocouples, Resistance Temperature Detectors, Thermistors, LVDT, Capacitive Transducers, Piezoelectric Transducers.

UNIT V **[08 hours]**

Transducers -II:

Strain Gauges- Types, Expression for gauge factor, Photosensitive Devices. Display Devices &Recorders : Method of Measuring Amplitude, Phase, Frequency & Period using CRO. Use of Lissajous Patterns. LCD & LED displays, Strip Chart & X-Y Recorders. Introduction to Printers.

TEXT BOOKS:

1. Modern Electronic Instrumentation & Measurement Technique- Albert D. Helfrick, William D. Cooper, 3/e, Pearson, Prentice Hall.
2. Electronic Instrumentation- H. S. Kalsi, Tata McGraw Hill.

REFERENCE BOOKS:

1. A Course in Electrical & Electronic Measurements & Instrumentation- A. K. Sawhney, 18/e, DhanpatRai& Co., New Delhi.
2. Electronic Instrumentation & Measurement- by David A. Bell, 2/e, PHI Publications.

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IV SEMESTER ELECTRICAL CLUSTER

Subject	Engineering Mathematics – 4 (Common to all branches except for CS and IS)	Sub. Code	10MA4ICMAT
Credits	04	L-T-P	3-1-0

Objectives

To prepare students with adequate knowledge in mathematics to succeed in industry and provide necessary platform to pursue academics, keeping pace with global standards. Topics spanned are Probability and Statistics, Complex Analysis and series solution of Differential Equations. The thrust is to identify and clarify concepts of mathematics needed for the graduation program.

UNIT I

Statistics:

Curve fitting – Fitting a straight line, fitting of a parabola, fitting of curves of the form $y = ae^{bx}$, $y = ab^{x}$, $y = ax^{b}$, Correlation and regression. **(4L+1T)**

Probability-1:

Probability of an event, axiomatic definition, addition theorem, conditional probability, multiplication theorem, Bayes' theorem. **(4L+2T)**

UNIT II

Probability-2:

Probability distributions: Random variables, Discrete probability distributions, continuous probability distributions, Some standard distributions: Binomial distribution, Poisson distribution, exponential distribution, normal distribution. **(7L+2T)**

UNIT III

Complex Analysis-1:

Function of a complex variable, Analytic functions, Cauchy-Riemann equations, construction of analytic functions, Cauchy-Riemann equations in Polar form.

Application To Flow Problems:

Complex potential, velocity potential, equipotential lines, stream functions, stream lines.

Transformations- $w = z^2$, $w = e^z$ and $w = z + \frac{a^2}{z}$ $(z \neq 0)$, Bilinear transformations.

(8L+2T)

UNIT IV

Complex Analysis-2:

Complex integration-Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's series, Singular points, poles, residues, the residue theorem. **(5L+2T)**

Series Solution Of Differential Equations:

Series solution-Frobenius method, series solution of Bessel's differential equation leading to Bessel function of first kind, equations reducible to Bessel's differential equation, series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula**.** **(4L+1T)**

UNIT V

Optimization:

Linear programming, mathematical formulation of linear programming problem (LPP), graphical method, simplex method, artificial variable technique- M method, two phase method. **(7L+3T)**

Text Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edn,. John Wiley & Sons
2. Higher Engineering Mathematics by B. S. Grewal, 40th Edn., Khanna Publishers

Reference Books:

1. Advanced Modern Engineering Mathematics by Glyn James, 3rd Edition, Pearson Education
2. Higher Engineering Mathematics by B.V. Ramana, Tata McGraw-Hill Publishing Company Ltd.,
3. Probability and Statistics by Murry R Spiegel, John Schiller and AluSrinivasan, Second edition, Schaumn's outline series.
4. Introductory methods in Numerical Analysis by S.S. Sastry, 4th edition, Prentice Hall of India

Subject	Op-amps and Linear ICs	Sub. Code	09ES4GCLIC
Credits	05	L-T-P	4-0-1

Objectives:

The opamp has become an important building block of linear integrated circuits and applications. The objective of this course is to offer the student proficiency in the analysis and design of circuits using linear IC's

Circuit configurations for linear ICs:

To understand the basic circuit configurations for linear IC's such as current sources, voltage sources and differential amplifier using BJT.

Operational amplifier characteristics:

To discuss the characteristics of 741 opamp.

Applications of Opamps:

To analyze the working of different applications of opamps such as filters, instrumentation amplifiers, comparators, waveform generators etc.

555 timer:

To understand the working principle of the timer and the use of the same in different areas.

A/D and D/A converters:

To understand the fundamentals of conversion techniques and various conversion methodologies.

UNIT I

Operational Amplifier Fundamentals: Operational Amplifier Description, basic operational Amplifier circuit, input and output voltage, common mode and supply rejection, offset voltages and currents, input and output impedances, slew rate and Frequency limitations.

Opamps as DC Amplifiers: Biasing operational Amplifiers, Direct coupled voltage followers, Direct coupled non-inverting amplifiers, Direct coupled inverting amplifiers, summing amplifiers, Difference amplifiers

UNIT II

Differentiating and Integrating Circuits: Differentiating circuit, Differentiator Design, Differentiating circuit Performance, Integrating Circuit, Integrator Design, Integrating Circuit performance

Signal Processing Circuits : Precision Half wave and Full wave Rectifiers, Limiting Circuits, Clamping circuits, peak Detectors, sample and hold circuit

UNIT III

Opamp Non Linear Circuits: opamp and switching circuits, crossing detectors, inverting and non-inverting Schmitt trigger circuits, Astable and MonostableMultivibrator.

Signal Generators: Triangular/rectangular wave generator, waveform Generator Design, phase shift oscillator, oscillator amplitude stabilization, wien bridge oscillator, Signal Generator output control.

UNIT IV

Active Filters: All pass phase shifting circuits, 1st order lowpass active filter, 2nd order low pass filter, 1st & 2nd order high pass filter

Voltage Regulators: Introduction, Series OpAmp Regulator, IC voltage Regulators, 723 General purpose Regulator.

UNIT V

555 Timer: Introduction, Description of Functional Diagram, Monostable and Astable Operation, Schmitt trigger.

A/D and D/A Converters: Introduction , Basic DAC Techniques, A:D Converters, DAC/ADC Specifications.

Lab Experiments:

Inverting amplifier, non-inverting amplifier, summing amplifier and voltage follower, precision halfwave and full wave rectifier, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, differentiator and integrator, Schmitt trigger and zero crossing detector, Wien bridge oscillator, first order lowpass and high pass filter, IC 723 low voltage and high voltage regulator Simulation experiments using Labview/ P-Spice.

TEXT BOOKS:

1. Operational Amplifiers and Linear IC's : David A.Bell, 2nd ed, PHI/Pearson, 2004.
2. Linear Integrated circuits: D.Roy Choudhury and Shail B.Jain,2nded, Reprint 2006, New Age International.

REFERENCE BOOK:

1. OpAmps and Linear Integrated Circuits: Ramakanth A.Gayakwad, 4th ed,PHI

Subject	8086 MICROPROCESSOR	Sub. Code	09ES4GCMPR
Credits	04	L-T-P	3-0-1

Objectives

This course focuses on microprocessor architecture, related hardware, introduces programming, interpolates hardware and software in interfacing microprocessor based products. It maintains a balance between basic concepts and skills needed for system design. The theoretical concepts and practical applications using 8086 microprocessor family gives a solid foundation for developing system architecture and embedded applications.

UNIT I **[08 hours]**

Introduction, Microprocessor based computer system, Architecture of 8086 Microprocessor, Pin functions, Clock generator, Minimum /Maximum mode of operation.

UNIT II **[08 hours]**

Read /Write Timing diagrams, Assembly level programming of 8086, 8086 instruction set, addressing modes. Assembler directives, Programming examples.

UNIT III **[08 hours]**

Stacks, Procedures and Interrupts. Interfacing 8086 with Memory devices.

UNIT IV **[08 hours]**

Interfacing 8086 with I/O devices.8255 PPI device, modes of operation.Interfacing.Keyboard, display, ADC, DAC, Stepper motor and Printer interfacing using 8255.

UNIT V **[07 hours]**

Programmable Interval Timer – modes of operation of 8253 and interfacing. 8087 Numeric data processor and interfacing, 8087 Data types.

LAB Experiments:

Data and address transfer operations, unsigned and signed arithmetic operations using instructions for add/sub/mul/div, logical operations, linear search and sorting, code conversion programs using procedures, interfacing I/O devices like DSC, stepper motors, Keyboard, 7 segment display to 8086 using 8255 PPI, realization of ALU, Counters and multiplexer using 8086.

TEXT BOOKS:

1. Advanced Microprocessor and Peripherals- A.K.Ray and K.M. Bhurchandi, Tata McGraw Hill.
2. Microcomputer systems 8086/8088 family, Architecture, Programming and Design - Yu-Cheng Liu & Glenn A Gibson, 2nd ed, July 2003, PHI.

REFERENCE BOOKS:

1. Microprocessor and Interfacing, Programming & Hardware- Douglas V Hall, 2nd ed, TMH
2. Microprocessor Architecture, Programming and Applications with the 8085- Ramesh S Gaonkar, 4thed, Penram International

Subject	SIGNALS AND SYSTEMS (EE/EC/IT/ML)	Sub. Code	09ES4GCSAS
Credits	04	L-T-P	4-0-0

Objectives

Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that is necessary for the analysis of continuous and discrete-time signals and systems. Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc. Knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform.

The overall objectives of each topic are:

- Introduction:
  - To determine whether a signal has the following properties: discrete time, continuous time, power, energy, periodic, a periodic, even, odd.
  - To perform the following operations on signals, alone or in combination: amplitude scaling, addition, multiplication, differentiation, integration time scaling, reflection, time shifting.
  - To determine whether an input/output description for a system has the following properties: stability, memory, memoryless, causality, inevitability (simple cases), time invariance, linearity.
- Time-domain Representations For LTI Systems:
  - To evaluate the convolution sum and integral given an input and the impulse response
  - To derive equation for characterize the natural response, forced response, and complete response for systems described by second order difference or differential equations
  - To discuss about Block diagram representations
- Fourier Representation For Signals – 1:
  - To drive an expression for properties of FS&DTFS.
  - To determine the FS &DTFS representation is appropriate for a give signal
- Fourier Representation For Signals – 2:
  - To drive an expression for properties of FT&DTFT.
  - To determine FT & DTFT representation is appropriate for a give signal.
- Applications Of Fourier Representations:
  - To study the Frequency response of LTI systems for Fourier transform representation of periodic signals.
  - To study the Frequency response of LTI systems forFourier transform representation of discrete time signals.

- Z-Transforms – 1:
  - To discuss the Z – transform and to drive an expression for properties of Z – transform.
  - To explain properties of ROC of Z – transforms and inversion of Z–transforms.
- Z-Transforms – 2:
  - To study of Transform analysis of LTI Systems, unilateral Z- Transform and its application to solve difference equations.
  - To study of LTI discrete-time signals and systems in the frequency domain using z-transforms (transfer function) and the discrete-time Fourier transform (frequency response).

UNIT I **[10 hours]**

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT II **[12 hours]**

Time-domain Representations For LTI Systems: Convolution, impulse response representation, Convolution Sum and Convolution Integral. Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT III **[12 hours]**

Fourier Representation For Signals - 1 : Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties .

Fourier Representation For Signals – 2: Discrete and continuous Fourier transforms(derivations of transforms are excluded) and their properties.

UNIT IV **[08 hours]**

Applications Of Fourier Representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals

UNIT V **[10 hours]**

Z-Transforms – 1: Introduction, Z – transform, properties of ROC, properties of Z – transforms, inversion of Z–transforms.

Z-Transforms – 2: Transform analysis of LTI Systems, unilateral Z- Transform and its application to solve difference equations.

TEXT BOOK:

1. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001. Reprint 2002

REFERENCE BOOKS:

1. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems"Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
2. H. P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005
4. Ganesh Rao and SatishTunga, "Signals and Systems", Sanguine Technical Publishers, 2004

Subject	CONTROL SYSTEMS	Sub. Code	09ES4GCCST
Credits	04	L-T-P	4-0-0

Objectives

This course aims at representation, performance analysis and stability analysis of linear time in variant control systems. This forms a background to the study of non-linear control systems.

Block Diagram, Signal Flow Graph:

To learn to represent Single Input and Single Output, Multiple Input and Multiple Output systems and evaluate their transfer functions.

Time response Of Systems:

To analyze control systems of first and second order with respect to their response to certain types of test inputs in the time domain.

To evaluate their performance through determination of various specifications in the time domain.

Stability Analysis:

To determine the stability of systems applying time- domain and frequency- domain analyses and using stability techniques such as BODE, ROOT LOCUS etc.

UNIT I **[12 hours]**

Introduction: Examples of Control Systems, open loop vs Closed loop Systems, Classifications of Control Systems. Mathematical Modeling of Linear Systems: Transfer functions, Mechanical Systems, Analogous Systems, Block diagram, Signal Flow graph (excluding gear trains lever).

UNIT II **[10 hours]**

Time Response Analysis of Control Systems : Step response of first order, second order systems, response specification, steady state error and error constants

UNIT III **[10 hours]**

Stability Analysis: Concept of stability, RH criterion, applications of RH criterion with limitations, Nyquist plot, Polar plots, Stability Analysis using Nyquist criterion.

UNIT IV **[10 hours]**

Root Locus Technique: Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot

UNIT V **[10 hours]**

Frequency Response Analysis: Bode plots, Relative stability, Frequency domain specification.

TEXT BOOK:

1. Control Engineering by Nagrath & Gopal, New Age International Publishers

REFERENCE BOOKS:

1. Modern control Engineering - Ogata, Prentice Hall
2. Automatic Control Systems - B.C Kuo, John Wiley and Sons

Subject	FUNDAMENTALS OF HDL	Sub. Code	09ES4GCHDL
Credits	04	L-T-P	3-0-1

Objectives

The objective of the course is to study the programming concepts of VHDL and verilog. The same is implemented using the simulation tools.

UNIT I **[07 hours]**

Introduction:

Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog.

UNIT II **[08 hours]**

Data-flow Descriptions:

Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT III **[08 hours]**

Structural Descriptions:

Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT IV **[08 hours]**

Procedures and Functions:

Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. Advanced HDL Descriptions: File Processing, Examples of File Processing.

UNIT V **[08 hours]**

Synthesis Basics:

Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

LAB Experiments:-

Verification of combinational logic circuits, sequential circuits using data flow and sequential descriptions & structural descriptions. Interfacing experiments : stepper motor, dc motor, relay, waveform generation.

TEXT BOOK:

HDL Programming (VHDL and Verilog)-NazeihM.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition

REFERENCE BOOKS:

1. Verilog HDL -Samir Palnitkar, Pearson Education
2. VHDL -Douglas Perry,TMH
3. Fundamentals of Digital Logic with Verilog Design-Stephen Brown, TMH
4. Circuit Design with VHDL-VolneiA.Pedroni, PHI

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V SEMESTER

Subject	Transmission and Distribution	Sub. Code	10EE5DCTND
Credits	04	L-T-P	4-0-0

Objectives

To under the concepts of power transmission and distribution system to learn the usage of passive elements in various Power Transmission Systems. To understand the factors affecting Insulators and also in Under Ground cables. To calculate the various parameters in Distribution System. To study line parameters and performance of transmission of lines.

The overall objectives of each topic are:

- Typical Transmission & Distribution Systems Scheme:
  - To provide an overview of components of power systems and line parameters.
  - To discuss the Standard voltages for transmission and advantage of high voltage transmission.
  - To explain a Feeders, distributors& service mains.
- Overhead Transmission Lines-:
  - To model the affects of sag in over head lines under various conditions.
- Insulators:
  - To discuss the types of insulators and derive an expression for potential distribution over a string of suspension insulators.
  - To explain the String efficiency & methods of increasing strings efficiency.
  - To discuss about the testing of insulators.
- Distribution:
  - To explain the radial & ring main systems and the ac to dc distribution.
  - To derive the calculation for concentrated loads and uniform loading.
- Underground Cables:
  - To introduce the types of underground cables, material used, and derive an expression for various cable parameter.
  - To introduce method of cable testing.
- Line Parameters:
  - To develop equation for calculation of inductance of 1Ö, 3Ö lines with equilateral & unsymmetrical spacing.
  - To develop equation for calculation of Capacitance-calculation for two wires & 3Ö lines, capacitance calculation for two wires 3Ö line with equilateral & unsymmetrical spacing.
- Performance Of Power Transmission Lines:
  - To obtain mathematical models of over head transmission lines and to analyze the performance based on developed models.

UNIT I

A:Typical Transmission & Distribution Systems Scheme- Standard voltages for transmission. Advantage of high voltage transmission. Feeders, distributors& service mains.

B:Overhead Transmission Lines- sag calculation in conductors a) suspended on level supports b) support at different levels. Effect of wind & ice tension &sag at erection. Stringing chart. **10 Hrs**

UNIT II

A:Insulators-Types, potential distribution over a string of suspension insulators. String efficiency & methods of increasing strings efficiency, testing of insulators.

B: Distribution- radial & ring main systems, ac to dc distribution: calculation for concentrated loads and uniform loading **10 Hrs**

UNIT III

Underground Cables- Types, material used, insulation resistance, thermal rating of cables, charging current, grading of cables, capacitance grading & inter sheath grading, testing of cables**.** **10Hrs**

UNIT IV

Line Parameters: calculation of inductance of single phase, 3phase lines with equilateral & unsymmetrical spacing. Capacitance-calculation for two wires & three phase lines, capacitance calculation for two wire three-phase line with equilateral & unsymmetrical spacing. **11 Hrs**

UNIT V

Performance Of Power Transmission Lines- Short Transmission-lines, medium Transmission-lines, nominal T method, π method and long transmission lines, ABCD constants of Transmission lines**.** **11 Hrs**

TEXT BOOKS:

1. **Transmission and Distribution –**J.B.Gupta, Kataria Publishers**.**
2. **Electrical Power Systems-** C. L. Wadhwa Wiley Eastern.

REFERENCE BOOKS:

1. **Elements of Power System Analysis-** W.D. Stevenson, Mc. Graw - Hill. Comp. Ltd.
2. **Electric power generation Transmission & Distribution-** Dr. S. N. Singh, PHI, 2007.
3. **Transmission & Distribution Hand Book -** Westing House Corporation**.**
4. **Electrical Power Transmission and Distribution-** S.Sivanagaraju and S.Satyanarayana, Pearson Education Private Limited.P.H.I., New Delhi.

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Subject	Fundamentals of Digital Signal Processing	Sub. Code	10EE5DCFDP
Credits	04	L-T-P	3-1-0

Objectives

In this course, students belonging to the Electrical and Electronics discipline are introduced to the fundamental concepts of digital signal processing, starting from its evolution, to its predominant use in development of new technologies for different applications. They apply mathematical concepts in obtaining the frequency spectrum and their reconstruction from the samples of signals. They also use algorithms for computation of frequency spectrum. They obtain system outputs through simplified processes using the properties of transforms. They develop structural representations for systems (filters)and design them for given specifications.

Introduction:

- To Illustrate the applications of digital signal processing.
- To highlight the contributions to development of technology through dsp.
- To appreciate the need for analyses of signals in the digital domain:
- To distinguish the distinctive features of analog signal processing and digital signal processing.
- To identify the problems associated with the sampling process.

Discrete Fourier Transform :

- To obtain the frequency spectrum of a signal from its sampled values (DFT) using mathematical techniques for its evaluation.
- To obtain the system response using the properties of DFT.

Block Convolution :

- To identify the need and to determine the system response for an input signal of different length of samples by different methods of block convolution.

Computation of Discrete Fourier Transform:

- To use the radix -2 algorithms for computation of the Discrete Fourier transform as well as reconstruction from sampled values of a signal.
- To list out the distinctive features ,advantages, disadvantages and computational efficiency of each.

Development of system structures:

- To classify digital systems based on the nature of their impulse response(IIR AND FIR).
- To realize system structures for both types with the help of block diagram

Design of Filters

- To design IIR (infinite impulse response) digital filters such as Butterworth and Chebyshev given their specifications in analog as well as digital domains using different methods of transformation from analog to digital domains.
- To design filters FIR(finite impulse response) by the windowing technique choosing the type of window based on the required specifications.
- To identify the drawback associated with windowing technique and know how it is overcome.

UNIT I

Introduction to DSP, Sampling and reconstruction of a discrete time signal in the frequency domain. Definition of Discrete Fourier Transform (DFT). Useful properties of DFT : linearity, circular shift, Multiplication by a complex exponential sequence,, Properties of even and odd parts of x[n], Multiplication, Parseval's relation.

(9L+2T) = 11 Hrs

UNIT II

(A) Circular convolution in the time domain ,use of tabular arrays and circular arrays, Use of DFT in linear filtering, linear convolution of two finite duration sequences, overlap add and save methods**.** **(4L+1T)=5 Hrs**

(B) Relation between DFT and other transforms. Direct computation of DFT. Necessity for efficient computation of DFT. Radix 2 Fast Fourier Transform (FFT) algorithm for DFT computation. Decimation in time algorithm, decimation in frequency algorithms. **(5L+1T)=6Hrs**

UNIT III

(A) Computation of 2N point DFT of a real sequence using single N point DFT. Computation of N point DFT of a real sequence using N point DFT. Decomposition for 'N', a composite number,. Number of computations, number of multiplications, computational efficiency, Radix 2 FFT algorithm for computation of Inverse Discrete Fourier Transform. (IDFT)

(B) Introduction to realization of digital systems, block diagrams, representation, Realization of Infinite Impulse Response (IIR) systems : direct form, parallel form, cascade form.

Realization of Finite Impulse Response (FIR) systems : Direct Form, Linear Phase Form**.** **(7L+4T) = 11Hrs**

UNIT IV

Introduction to IIR filters, impulse invariant & bilinear transformations, Design of analog filters: Design of Digital filters: Butterworth and Chebyshev. Frequency transformations. **(6L+2T) = 8 Hrs**

UNIT V

(A) Introduction to FIR filters, Frequency response of ideal digital low pass filter, high pass filter, frequency sampling technique of designing FIR filters.

(B) Windowing,. Design of FIR filters using rectangular , triangular, Hamming, Hanning and Blackman window. Gibbs phenomenon (qualitative discussion only), comparison between IIR and FIR filters**.** **(8L+3T)=11 Hrs**

TEXT BOOKS:

1. **Digital Signal Processing, A computer based approach,** Sanjit K Mitra, Tata McGrawHill, Third Edition,
2. **Digital Signal Processing, Principles, Algorithms and Applications,** John G. Proakis, Dimitris K Manolakis, Pearson education/PHI, (4th Edition)

REFERENCE BOOKS:

1. **Fundamentals of Digital Signal Processing,** LonnieLudeman, John Wiley & Sons; Wiley International 1st Edition, 1988.
2. **Discrete-Time Signal Processing,** Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, Prentice-Hall Signal Processing Series,2nd Edition, 1999
3. **Understanding Digital Signal Processing,** Richard G. Lyons Prentice Hall, March 25, 2nd Edition 2004
4. **Digital Signal Processing: Fundamentals and Applications,** Li Tan,Academic Press, 1st edition 2007
5. **Schaum's Outline of Digital Signal Processing,** Monson Hayes, McGraw-Hill, 1st edition, 1998)

Subject	Transformers & Induction Machines	Sub. Code	10EE5DCTIM
Credits	05	L-T-P	4-0-1

Objectives

This Course is the backbone of the power sector, the analysis of which is very important for practising

Electrical engineers. This Course takes the student through various aspects of electrical machine

performance & analysis. This Course is the prerequisite for the power system courses. The complementary laboratory course helps the student to understand the various control methods & testing methods of Electrical machines.

Transformers

To analyse the principle of operation & construction of single phase transformer.

To develop the electrical equivalent circuit of a single phase transformer.

To draw the phasor diagram of a practical transformer under no load &loaded conditions.

Testing the transformer for the measurement of losses.

To Evaluate the performance quantities like efficiency & voltage regulation.

To appreciate three phase transformer connections & their usage.

Induction Machines

To analyse the principle of operation & construction of three phase induction motors.

To develop the equivalent circuit of a three phase induction motor.

To obtain the performance evaluation of 3 phase induction motor thro' equivalent circuit & circle diagram.

To analyse the performance of high starting torque cage motors.

To Distinguish the Starting methods & speed control methods of 3 phase induction motor.

UNIT I

(A)Basic Concepts: Principle of transformer action for voltage transformation. Constructional details of shell type and core type single-phase transformers.

(B) Single-phase Transformers: Concept of ideal transformer. Equation for E.M.F. induced in the two windings. Voltage transformation ratio. Ideal transformer on no-load and loaded condition with corresponding phasor diagrams. Concept of M.M.F. balance in the magnetic circuit of an ideal transformer. Current transformation ratio. Concept of referring impedance connected on one side of ideal transformer to the other side. Practical transformer - how it deviates from the ideal transformer. Development of exact equivalent circuit of a practical transformer - visualization of a practical transformer as an ideal transformer combined with imperfections of electric and magnetic circuits. Approximate equivalent circuit of a practical transformer. **11 Hrs**

UNIT II

Phasor diagram of a practical transformer for both no-load and loaded conditions. Losses, power and all-day efficiency, regulation. Testing of transformers — O.C. test, S.C. test and predetermination of efficiency and regulation. Sumpner's test. Parallel operation — need, conditions to be satisfied for parallel operation. Load sharing. **10 Hrs**

UNIT III

Three-phase Transformers: All types of three-phase transformer connections. Choice of connections. Bank of single-phase transformers for three-phase operation. Phase conversion using transformers. Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals. **9 Hrs**

UNIT IV

Basic Concepts of Induction Machines: Concept of rotating magnetic field. Operating principle, construction, classification and types — single-phase, three-phase, squirrel-cage, slip-ring, Three-phase Induction Motor: Phasor diagram of induction motor on

no-load and loaded conditions. Visualization of a three-phase induction motor as a generalized transformer with a rotating secondary and obtaining its equivalent circuit. Different kinds of power losses in an induction motor. Efficiency. Performance evaluation — output power, torque, efficiency, current and power factor. **10 Hrs**

UNIT V

(A) Torque-slip characteristics covering motoring, generating and braking regions of operation. Induction generator. No-load and blocked rotor tests. Circle diagram and therefrom performance evaluation of the motor. Cogging and crawling. Equivalent circuit and performance of double-cage and deep-bar motors. —

(B) Starting and Control of Three-phase Induction Motor, Need for starter. DOL, Y-Delta and auto-transformer starting. Rotor resistance starting.. Speed control — voltage, frequency, and rotor resistance variations.

(C) Single-phase Induction Motor: Double revolving field theory and principle of operation. Types of single-phase induction motors: split-phase, capacitor start, shaded pole motors. **12Hrs**

Laboratory Experiments Test on single phase transformer: OC, SC test and pre-determination of efficiency and regulation, Load test and performance evaluation, Sumpner's test, polarity test, Parallel operation, Three phase transformer connections and scott connection. Tests on three phase induction motor. Load test, OC and SC tests and development of equivalent circuit and performance evaluation through Circle diagram, Speed control of 3-phase induction motor. Load test on single phase induction motor, OC and SC test and development of equivalent circuit.

TEXT BOOKS:

1. **Theory and performance of Electrical Machines –** J.B.Gupta .., S.K.Kataria and sons –New Delhi.
2. **Transformers and Induction Machines, Dr**.A S AravindMurthy, Pearson Publications.

REFERENCES :

1. **"Electric Machines**", I. J. Nagrath and D. P. Kothari, 3rd Edition, T.M.H., Education Pvt Ltd.., New Delhi

Subject	**Electrical Power Generation**	**Sub. Code**	**10EE5DCEPG**
Credits	**03**	**L-T-P**	**3-0-0**

Objectives:

1. To list sources of Electrical Power: Different types of energy avenues/ methods/ generation.
2. To identify the purpose of nuclear power as an alternative to fossil fuels, problems encountered with nuclear power stations.

3. To know the operation of Diesel Power plants: diesel and gas turbine power plants.
4. To contemplate over use of Water as a perpetual element for power generation and coal based power generation.
5. To distinguish and compare different types of cost structures and hence tariff for power generation power factor improvement to reduce load, plant capacity and cost of power.
6. To recognize bus bar arrangement of power transmission, different types and their placement. To list the limitations of current using reactors and MVA calculation during short circuit on power systems.

UNIT I

Sources Of Electrical Power: Conventional and nonconventional sources: Introduction, environmental impact, prospects, development, applications, recent advances in energy resources (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation **8 Hrs**

UNIT II

(A) Nuclear Power Station: Introduction.Adverse effects of fossil fuels. Pros and cons of nuclear power generation. Selection of site, cost, components of reactors. Description of fuel sources. Safety of nuclear power reactor.

(B) Diesel electric plants. Gas turbine plants. Mini, micro, and bio generation. Concept of distributed generation. **8 Hrs**

UNIT III

(A) Hydro Power Generation: Selection of site. Classification of hydro-electric plants. General arrangement and operation. Hydroelectric plant power station structure and control.

(B) Thermal Power Generation: Introduction. Main parts of a thermal power plant. Working Plantlayout. **8 Hrs**

UNIT IV

(A) Economics Aspects: Introduction. Terms commonly used in system operation. Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor, loss factor, load duration curve.

(B) Power factor improvement and tariffs. Energy-load curve **8 Hrs**

UNIT V

(A) Substations: Introduction. Types. Bus bar arrangement. Schemes. Location. Substation equipment. Reactors and capacitors .

(B) Current limiting reactors. Symmetric short circuit MVA calculations. **7 Hrs**

TEXT BOOKS:

1. **"Power System Engineering",** A. Chakrabarti, M. L. Soni, and P.V. Gupta, DhanpatRai and Co., New Delhi.

2. **"Elements of Power System Design",** M. V. Deshpande, A. H. Wheeler and Co.

REFERENCES:

1. **"Electric Power Generation, Transmission and Distribution",** Dr. S. N. Singh, P.H.I., New Delhi.

Subject	Microcontrollers	Sub. Code	10ES5GCMCS
Credits	04	L-T-P	3-0-1

Objective:

The objective of this course is to introduce the students to the fundamental concepts of 8051 Microcontrollers.

During the course, the students will be learning about the internal architecture of the 8051 Microcontroller and the instruction set. They will be learning to write assembly programming. Programming in Embedded C is also included in the syllabus. The course also includes lab sessions in order to strengthen the programming skills. The lab sessions include programming in Assembly language as well as programming using Embedded C code for interfacing experiments.

The overall objectives of different topics are:

8051 Architecture:

- To distinguish between Microcontrollers and Microprocessors
- To review different types of architectures
- To understand the architecture of the 8051 Microcontroller

Addressing modes and Instruction set:

- To learn the different types of addressing modes and instruction set.
- To apply these concepts to understand the operations like data transfer, arithmetic, logical and branching instructions.

Programming in C:

- To distinguish between Embedded C and 8051 Assembly Programming
- To develop programs using Embedded C language.

Timer / Counter, Interrupts Programming:

- To analyze the different operating modes of the Timers and different types of Interrupts.
- To program Timers in different modes to create delays, waveform generation, using both Embedded and Assembly code.
- To create and analyze interrupt driven programs using both Embedded and Assembly code.

8051 Serial Communication:

- To learn basics of serial communication, different modes and baud rate calculations
- To create programs to communicate to display unit/any other unit through serial port of 8051 .

8051 Interfacing and Applications:

- To have an idea of the interfacing concepts of 8051
- To interface and analyze the behavior of various devices/machines like DAC,LCD display, Stepper motor, DC motor using 8051 Embedded C/ Assembly language
- To enable the students to carry out project work using 8051 Microcontroller.

UNIT I

Introduction to Microcontrollers:

Microprocessors and microcontrollers : Introduction,Difference between Microprocessors and Microcontrollers. RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. Embedded Electronic Systems and Microcontrollers, comparison of Different microcontrollers and applications.

The 8051 Architecture: Introduction, 8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits, External Memory. **8 Hrs**

UNIT II

Assembly Language Programming in 8051

Addressing Modes and Instruction set: Introduction, Addressing modes, Data transfer instructions, Example programs, Arithmetic instructions, Logical instructions, Example programs, JUMP and CALL Program range, Jumps, calls and Subroutines, Returns, Example Programs. **8 Hrs**

UNIT III

Embedded 'C' Programming :

8051 programming in C: Data types and time delays in 8051 C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization.

Timer / Counter Programming in 8051: Counters and timers, programming 8051 Timers, Counter Programming, programming timers 0 and 1 in 8051 C. **8hrs**

UNIT IV

8051 Serial Communication: Basics of Serial Communication- Serial data input/output, 8051 connections to RS-232, 8051 Serial communication Programming.

Interrupts Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt programming in C. **8 hrs**

UNIT V

8051 Interfacing and Applications:

Interfacing 8051 to LCD, Keyboard, DAC, ADC, Stepper motor, DC motor interfacing and PWM. **7hrs**

Laboratory Experiments:

A. Data Transfer, Logical-Byte/Bit manipulations ,Jump and Subroutine Calls using Assembly-Language Programming

B. Interfacing: Counters and generate delay using timers, LCD Display, Stepper motor control using interrupt, Serial transmission/Receiving of Number of characters using serial interrupt, Temperature Controller interface, Elevator interface and 7 segment interface.

The Experiments will be implemented using 'Keil' software with Embedded IDE. For interfacing programs 8051 target board is used.

TEXT BOOKS:

1. **"The 8051 Microcontroller Architecture, Programming & Applications",** Kenneth J. Ayala 2e, Penram International, 1996 / Thomson Learning 2005
2. **"The 8051 Microcontroller and Embedded Systems - using assembly and C",** Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rolin D. McKinlay; PHI, 2006 / Pearson, 2006

REFERENCE BOOKS:

1. **"Programming and Customizing the 8051 Microcontroller",** Predko ;, TMH
2. **"Microcontrollers: Architecture, Programming, Interfacing and System Design",** Raj Kamal, Pearson Education, 2005
3. **"PIC Microcontrollers",** 3.J.B. Peatman;" PHI, 2006

Subject	**Electrical Measurements and Control Systems lab**	**Sub. Code**	**10EE5DCMCL**
Credits	**01**	**L-T-P**	**0-0-1**

1. To measure (a) Medium resistance by Wheatstone bridge, (b) Low resistance by Kelvin's Double Bridge. (c) High Resistance by Megger.
2. Measurement of Inductance and Capacitance by (a) A-V-W Method (b) Three Voltmeter Method.
3. Measurement of Inductance and Capacitance using A.C Bridges
4. Calibration of Single Phase Energymeter
5. To measure the variation in speed of a dc servomotor in terms of voltage and frequency using an optical sensor and a frequency to voltage converter.

6. Using MATLAB, to simulate a typical second order system and to determine the step response and to evaluate ζ (a) the time- domain specifications for different values of ζ

   (b) the effect of change in ζ on pole location and stability

7. (a) Using MATLAB, to design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.

   (b) Verify experimentally the frequency response of the above lead compensating network.

8. (a) Using MATLAB, to design a RC lag compensating network for the given specifications., viz., the maximum phase lag and the frequency at which it occurs, and to obtain its frequency response

   (b) Verify experimentally the frequency response of the above lag compensating network.

9. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system. Verify the same by simulation using MATLAB/SIMULINK.

10. Using MATLAB comparative study of Bode Plots and Root locus w.r.t. Stability.

BMS COLLEGE OF ENGINEERING, BANGALORE

(Autonomous College under VTU)

VI SEMESTER

Subject	POWER SYSTEM ANALYSIS	Sub. Code	11EE6DCPSA
Credits	04	L-T-P	3-1-0

Objectives

Representation of Different elements of Power systems and their interconnection,short circuit studies, symmetrical components,sequence impendence & networks, and unsymmetrical fault analysis using symmetrical components.

The overall objectives of each topic are:

- Representation of power system components:
  - To model the elements of power system
  - To review basic concepts of Circuit models of Transmission line.
  - To obtain the components of power systems and draw the one line diagram, impedance and reactance diagram.
  - To develop equation in per unit system.
- Formation of Y-bus and Z-bus and Symmetrical 3 - Phase Faults:
  - To develop the Formation of Y-bus and Z-bus& Matrix partitioning technique.
  - To study on Transients on a transmission line, Short-Circuit currents and the reactance of synchronous machines on load and on no load.
- Symmetrical Components:
  - To study Dr.Fortescue's theorem of symmetrical components.
  - To discuss the sequence components for voltage and current
  - To develop equation for impendence offered to Positive, Negative and Zero sequence currents in symmetrical circuits.
  - To discus on Phase shift of symmetrical components in star-delta/delta-star transformer bank,
  - Derive an expression for power in terms of symmetrical components.
- Sequence Impedances and Networks of Power System Elements:
  - To develop relation of Analysis of balanced and unbalanced loads against unbalanced 3 phase supply.
  - Sequence impedances and networks of power system elements (alternator, transformer and transmission line) Sequence networks of power systems.
- Unsymmetrical faults:
  - Analysis of L-G, L-L, L-L-G faults on an unbalanced alternator with and without fault impedance.
  - Concept of Open conductor faults in power system.

UNIT I **[7L+3T]**

Representation Of Power System Components: Circuit models of Transmission line, Synchronous machines, Transformer and load. One line diagram, impedance and reactance diagram. Per unit system, per unit impedance. Single line diagram of power system.

UNIT II **[8L+2T]**

Formation of Y-bus and Z-bus, Matrix partitioning technique, Symmetrical 3 - Phase Faults: Transients on a transmission line, Short-Circuit currents and the reactance of synchronous machines on load and on no load.

UNIT III **[7L]**

Symmetrical Components: Analysis of unbalanced load against balanced Three-phase supply, neutral shift, Resolution of unbalanced phasors into their symmetrical components, Phase shift of symmetrical components in star-delta transformer bank, Power in terms of symmetrical components.

UNIT IV **[7L+4T]**

Analysis of balanced and unbalanced loads against unbalanced 3 phase supply, Sequence impedances and networks of power system elements (alternator, transformer and transmission line) Sequence networks of power systems.

UNIT V **[10L+4T]**

Unsymmetrical Faults:

L-G, L-L, L-L-G faults on an unbalanced alternator with and without fault impedance. Unsymmetrical faults on a power system with and without fault impedance. Open conductor faults in power system.

TEXT BOOKS:

1. Elements of Power System Analysis- W.D.Stevenson, -TMH,
2. Modern Power System Analysis-.I. J. Nagrath and D.P.Kothari- TMH, New Delhi

REFERENCE BOOKS:

1. Power System Analysis- Hadi Sadat- TMH
2. Power system Analysis- R.Bergen, and Vijay Vittal- Pearson publications, second edition.
3. Computer Aided Power system analysis- G.L., Kusic- PHI.
4. Power System Analysis- W.D.Stevenson& Grainger- TMH

Subject	DC AND SYNCHRONOUS MACHINES	Sub. Code	10EE6DCDSM
Credits	05	L-T-P	4-0-1

Objectives

The course mainly aims at the detailed concepts of electrical machines such as dc motors, synchronous generators, synchronous motors.Students learn the various types of these machines, their control, analysis and applications.This course gives a solid base to understand various courses in future such as Power system analysis, Industrial Drives & Applications etc..,

The dc machine is the first to be dealt with, and gives an insight into various concepts like distinctive characteristics, types of dc generators and motors, speed control, important phenomenon such as armature reaction, commutation, testing of dc motors, and applications.

Under the synchronous machines, firstly the course introduces to the concepts of Synchronous generators(alternators), factors affecting the emf generated,various methods to evaluate the important performance parameter such as voltage regulation. It also gives an important practical aspect i.e synchronization of alternators and their operation under various conditions such as variable excitation, variable frequency.

The objectives of the contents under Synchronous Motor is the principle of operation, starting methods,phenomenon of hunting etc..,

DC Generator

To Expose various concepts such as armature reaction, commutation, use of interpoles and compensating winding. Analysis of the behavior of generators through load characteristics.

DC Motors

To discuss elementary treatment of types of dc motors and their characteristics, Detailed analysis of various methods of Speed Control. Losses in dc machines

Testing of DC Machines and Applications

To evaluate the performance parameters such as efficiency by analyzing the behaviour of dc machines by various testing methods.

Synchronous Machines

To focus on the basic principles, constructional features.

To Evaluate of performance parameter such as voltage regulation of alternators using various methods.

Synchronisation

To discuss the concept, necessity conditions of synchronization. Parallel operation of alternators.

To analyse the behavior of alternators in synchronism

To analyse thebehavior of synchronous machines using equations,capability curves of synchronous generators.

To discussthe methods of starting.

UNIT I

A) DC Generator- Review : Classification of DC generator, types of armature winding, EMF equation, armature reaction, commutation, No load & load characteristics, use of interpoles & compensating winding (only qualitative analysis).

B) DC Motors- Review : Classification, Back EMF equation, Torque equation, Characteristics of shunt, series & compound motors,

Speed control of shunt, series & compound motors, losses in DC machines (both generator and motor) **11 Hrs**

UNIT II

Testing of DC Machines and Applications, Power flow diagrams, direct & indirect methods of testing of DC machines, Swinburne's test, Hopkinson's test, Retardation test, applications of DC motors, **10 Hrs**

UNIT III

Synchronous Machines- Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution of winding and use of chorded coils.

Voltage Regulation: Voltage regulation by EMF, MMF, Potier Triangle method, voltage regulation of salient machines. **12Hrs**

UNIT IV

Synchronisation: Concept, necessity, conditions, Synchronizing to infinite bus bars, parallel operation of alternators. Operating characteristics, power angle characteristics excluding armature resistance, operation for fixed power input and variable excitation and vice-versa for both generating and motoring modes **10 Hrs**

UNIT V

V curves of synchronous machines, power flow equations including armature resistance, capability curves of synchronous generators, hunting in synchronous machines, damper winding, starting methods. **9 Hrs**

Lab Experiments:

Load characteristics of a D.C. generators, Load test on a DC motor, Swinburne's Test, Hopkinson's Test, Retardation test, Speed control of DC motor by armature voltage control, flux control, Ward Leonard method, Voltage regulation of a non-salient pole alternator by EMF, MMF method and ZPF method. Slip test. Synchronization of alternator in parallel with the bus-bars. V curves of a synchronous motor.

TEXT BOOKS:

1. **Theory and performance of Electrical Machines, J**.B.Gupta, S.K.Kataria and sons -New Delhi.
2. **DC and Synchronous Machines,** Dr. A S Aravind Murthy, Pearson Publications.

REFERENCES : .

1. "Electric Machines", I. J. Nagrath and D. P. Kothari, 3rd Edition, T.M.H., Education Pvt Ltd.., New Delhi

Subject	POWER ELECTRONICS	Sub. Code	10EE6DCPEN
Credits	05	L-T-P	4-0-1

Objectives

The scope and objective of the course is to develop an understanding of state of the art in power electronic devices and circuits: their operations, performance, protection and applications.

The overall objectives of each topic are,

- Introduction, power Semiconductor Devices:
  - To impart knowledge on different applications of power electronics.
  - To understand the concept of power semiconductor devices used as a switch.
  - To learn the Control characteristics of power semiconductor devices.
  - To study the switching characteristics of power transistor, MOSFET.
- Thyristors:
  - To learn the characteristics of thyristor.
  - To study the concept of two transistor model turn-on, turn -off.
  - To understand different classification of thyristors.
- Control Rectifiers:
  - To study the principle of phase controlled converter and
  - To expose students to the concepts of different types of 1ϕ & 3ϕ converters such as semi-converter, full converter
- Inverters:
  - To impart knowledge on principle of operation of inverter, the performance parameters.
  - To study different types of inverters both 1ϕ & 3ϕ.
- Choppers:
  - To study the concept dc-dc converter& its principle ,performance parameters.
  - Classification of choppers & also to study the concept of AC voltage controllers

UNIT I

Introduction, Power Semiconductor Devices: Applications of Power Electronics, Power semiconductor devices, Control Characteristics. Types of power electronic circuits. Peripheral effects. Power Transistors: Power BJT's – switching characteristics, switching limits. Power MOSFET's – switching characteristics, gate drive. IGBT's, di/dt and dv/dt limitations. Isolation of gate and base drives. Simple design of gate and base drives. **10 Hrs**

UNIT II

Thyristors: Introduction, characteristics. Two Transistor Model. Turn-on and turn-off. di/dt and dv/dt protection. Thyristor types. Thyristor firing circuits. Simple design of firing circuits using UJT, op-amps, and digital IC's. Commutation Techniques: Introduction. Natural Commutation. Forced commutation: self commutation, impulse commutation, resonant pulse commutation and complementary commutation**.**

10 Hrs

UNIT III

Controlled Rectifiers: Introduction. Principle of phase controlled converter operation. Single- phase semi-converters. Full converters. Three-phase half-wave converters. Three-phase full-wave converters. **10 Hrs**

UNIT IV

Inverters: Introduction. Principle of operation. Performance parameters. Single-phase bridge inverters. Three phase inverters. Voltage control of single-phase inverters – single pulse width, multiple pulse width, and sinusoidal pulse width modulation. Current source inverters. Variable D.C. link inverter. **11 Hrs**

UNIT V

DC Choppers: Introduction. Principle of step-down and step-up chopper with R-L load. Performance parameters. Chopper classification. AC Voltage Controllers: Introduction. Principle of ON-OFF and phase control. Single-phase bidirectional controllers with resistive and inductive loads. **11 Hrs**

Laboratory Experiments

1. Static characteristics of SCR, MOSFET and IGBT.
2. SCR turn-on circuit using synchronized UJT relaxation oscillator.
3. SCR Digital triggering circuit for a single-phase controlled rectifier OR A.C. voltage controller.
4. Single-phase fully controlled convertor with R and R-L loads (CCM mode only).
5. A.C. voltage controller using TRIAC and DIAC combination connected to R and R-L loads.
6. Speed control of a separately excited D.C. motor using an IGBT or MOSFET based chopper.

7. Simulation Study of Power Electronic Circuits (Controlled Rectifiers or Choppers)
8. MOSFET OR IGBT based single-phase full-bridge inverter connected to R load.

TEXT BOOK:

1) "Power Electronics", M.H.Rashid 2nd Edition, P.H.I. /Pearson, New Delhi, 2002.

2) "Power Electronics - Converters, Applications and Design", Net Mohan, Tore M. Undeland,and William P. Robins, Third Edition, John Wiley and Sons.

REFERENCES

1. "Thyristorised Power Controllers", G.K. Dubey, S.R. Doradla, A. Joshi and R.M.K. Sinha, New Age International Publishers.

2. "Power Electronics", M.D. Singh and Khanchandani K.B., T.M.H., 2001.

3. "Power Electronics", Cyril Lander, 3rd Edition, McGraw-Hill.

Subject	MODERN CONTROL THEORY	Sub. Code	10EE6DCMCT
Credits	03	L-T-P	3-0-0

Objective

The objective of this course is to introduce the state space approach for modeling and control of linear systems using state space approach. It is also intended to give an introduction to the non linear systems. This course is intended to make students develop the ability to do the following

1) Modeling :

To create state models using physical variables, mathematical variables and to solve the state equation.

2) Check Controllability and observability :

To Check the system for its Controllability and observability which is helpful in the design of controller.

3) Design controllers :

To develop ability to design of controllers using state feed back with state observers.

4) Nonlinear systems analysis :

To develop ability to classify nonlinear systems and apply the phase plane method for the analysis of some simple nonlinear systems.

UNIT I

State Variable Analysis and Design:

Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. **8 Hrs**

UNIT II

Derivation of transfer function from state model, Eigen values, Eigen vectors, generalized Eigen vectors. Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method**.** **8 Hrs**

UNIT III

Concept of controllability &observability, methods of determining the same, Effect of Pole-Zero Cancellation. Duality**.** **7 Hrs**

UNIT IV

Pole Placement Techniques:

Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer**.** **8 Hrs**

UNIT V

Non-linear systems:

Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. Phase plane method, singular points, stability of nonlinear system, limit cycles, construction of phase trajectories. **8Hrs**

TEXT BOOKS:

1. **Digital control & state variable methods-**M. Gopal - 2nd edition, THM Hill 2003
2. **Control system Engineering-**I. J. Nagarath& M. Gopal, - 3rdedition, New Age International (P) Ltd.

REFERENCE BOOKS:

1. **State Space Analysis of Control Systems-** Katsuhiko Ogata -Prentice Hall Inc
2. **Automatic Control Systems-**Benjamin C. Kuo&FaridGolnaraghi, 8th edition, John Wiley & Sons 2003.
3. **Modern Control Engineering-** Katsuhiko Ogata- PHI 2003
4. **Modern control systems-** Dorf & Bishop- Pearson education, 1998

VII SEMESTER

Subject	COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS	Sub. Code	11EE7DCCTP
Credits	05	L-T-P	4-0-1

Objectives

Over the years, the power system has grown in size and is highly interconnected due to operational reasons. The power utilities need to carry out a number of studies in order to ensure proper planning, operation and control of modern day power systems. The aim of the course is to equip the student with the knowledge required to carry out the various studies on practical power systems. The course is designed to fulfill the following objectives.

1. To acquaint the student with the mathematical background for carrying out a load flow study. The formulation of the load flow problem and different iterative methods to solve the problem are introduced.
2. To introduce the student to topic of optimal operation of power systems. The application of mathematical optimization techniques in order to solve the economic dispatch problem is introduced.
3. To introduce the concept of power system stability. The student learns numerical methods for solving non-linear differential equations used for transient stability analysis.
4. For the different problems identified above, the student learns to carry out simulation studies by developing a computer program or by means of a standard software package.

UNIT I **[10 hours]**

Network Formulation, representation of transmission lines and transformers with off nominal turns ratio,Formation of Y_{bus} by inspection. Bus incidence matrix, Primitive network - impedance form and admittance form, Y_{bus} by singular transformation, Z_{bus} building algorithm (without mutuals).

UNIT II **[10 hours]**

Power flow equations, Classification of buses, Operating constraints, Data for load flow; Gauss-Seidel Method - Algorithm and flow chart for PQ and PV buses (numerical problem for one iteration only), Acceleration of convergence.

UNIT III **[10 hours]**

Newton-Raphson Method - Algorithm and flow chart for NR method in polar coordinates (numerical problem for one iteration only), Algorithm for Fast Decoupled load flow method, Comparison of Load Flow Methods.

UNIT IV **[12 hours]**

Economic Operation of Power System: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation

scheduling including generator limits and neglecting losses; Economic Dispatch including transmission losses, Derivation of transmission loss formula, iterative technique for solution of economic dispatch with losses.

UNIT V **[10 hours]**

Stability Studies: Steady state and transient stability, Rotor dynamics and the swing equation, Power angle equation for salient and non-salient pole machines, Equal area criterion for transient stability evaluation and its applications, Numerical solution of Swing Equation - Point-by-point method

Lab Experiments

1. Y_{bus} formation for power systems with and without mutual coupling, by singular transformation and inspection method.
2. Determination of bus currents, bus power and line flow for a specified system bus voltage Profile
3. Formation of Z_{bus}, using Z_{bus} building Algorithm without mutual coupling.
4. ABCD parameters:
   (i) Formation for symmetric π and T configuration.
   (ii) Verification of AD-BC=1
   (iii) Determination of efficiency and regulation
5. To determine (i) Swing curve (ii) critical clearing time, for a single m/c infinite bus system with a double circuit line, for a 3- phase fault on one of the lines. Simulation for the above to be conducted with variations in inertia constant/line parameters /fault location/clearing time/pre-fault electrical output.
6. Formation of Jacobian in polar coordinates.
7. To perform load flow using Gauss- Seidel method (only PQ bus)
8. Load flow analysis using Gauss Siedel method, NR method, Fast decoupled flow method for both PQ and PV buses.
9. Optimal Generator Scheduling for Thermal power plants.
10. To determine fault currents and voltages in a single transmission line system with star-delta transformers at a specified location for SLGF, DLGF.

Note: Write programs for Experiments 1-7, use Simulation Package for Experiments 8-10.

TEXT BOOKS:

1. **Computer Methods in Power System Analysis-** Stagg, G. W., and EI-Abiad, A. H.- McGraw Hill International Student Edition. 1968
2. **Computer Techniques in Power System Analysis**-Pai, M. A- TMH, 2nd edition, 2006.
3. **Modern Power System Analysis**-Nagrath, I. J., and Kothari, D. P., -TMH, 2003.

4. **Power System Analysis,** W.D Stevenson, TMH
5. **Computer Techniques and Models in Power Systems,** K. Uma Rao, I.K International.

REFERENCE BOOKS:

1. **Advanced Power System Analysis and Dynamics** - Singh, L. P., New Age International (P) Ltd, New Delhi, 2001.
2. **Power System Analysis -** Haadi Sadat, - TMH, 2nd, 12th reprint, 2007

Subject	SWITCHGEAR AND PROTECTION	Sub. Code	11EE7DCSGP
Credits	05	L-T-P	4-0-1

Objectives

Fuses and Protective Relays:

To have knowledge of various switchgear components . The students being able to list and identify the types of fuses. The ability to know the applications of the main components used in power system protection. To develop an understanding of switch sizes, ratings and requirements. Students being knowledgeable in selecting the qualities and having a choice in designing the required type of relay for a particular abnormal condition.

Electromechanical Relays:

Students are knowledgeable in the field of relays. Students will demonstrate and ability to design the relevant protection systems for the main elements of a power system. The ability to design over current protection relay, which can operate on the permissible conditions by setting the over current value. The ability to test unwanted conditions (over current) and when such conditions arise to isolate the fault condition in the shortest time possible. To investigate IDMT curve characteristic. To develop the skills of practical system design.

Circuit Breakers:

To identify the types of circuit breakers. To establish an understanding of circuit breaker operation, figures of merit, design, ratings and their effect on reliability. To provide an appreciation of the need for different ratings, and to develop skills in applying appropriate correction techniques under various supply and load conditions. Examine the causes and effects of transients at the distribution level and the application of various protection schemes.

Static Relays:

An abilty to differentiate the static relays operation from the conventional relays. To understand the knowledge of basic operation of static relays. An ability to design various components involved in static relays operation. The student shaving necessary foundation for functioning of sensors involved and design of individual subcomponents and their coordination.

Comparators:

To have a knowledge of classification of comparators and their importance. An ability to apply knowledge of mathematics and engineering. An ability to design and conduct experiments, as well as to analyze and interpret data. An ability to design a system, component, or process to meet desired needs within constraints such as economic, environmental, safety, manufacturability, and sustainability.

UNIT I **[10 hours]**

Switches And Fuses: Isolating switch, load breaking switch, Fuse law, cut -off characteristics, Time current characteristics, fuse material, HRC fuse,liquid fuse, Application of fuse.

Protective Relaying: Requirement of Protective Relaying, Zones of protection, primary and backup protection, Essential qualities of Protective Relaying, Classification of Protective Relays.

UNIT II **[10 hours]**

Induction Type Relay: Non-directional and directional over current relays, IDMT and Directional characteristics. Differential relay - Principle of operation, percentage differential relay, bias characteristics, distance relay, Impedance relay, Reactance relay, Mho relay, Buchholz relay, Negative Sequence relay.

UNIT III **[10 hours]**

Principles Of Circuit Breakers: Principles of AC Circuit breaking, Principles of DC Circuit breaking, problems encountered in DC breaking, Initiation of arc, maintenance of arc, Arc interruption - high resistance and low resistance interruption, Arc interruption theories - slepian's theory and energy balance theory, Re striking voltage, recovery voltage, Rate of rise of Re striking voltage, Rating of Circuit breakers

Circuits Breakers: Air Circuit breakers - Air break and Air blast Circuit breakers, SF6 breakers, Vacuum Circuit breakers, Construction, principle of operation, Advantages and disadvantages of different types of Circuit breakers.

UNIT IV **[10 hours]**

Static Relays: Introduction, Basic construction, Classification, Basic Circuits, Smoothing Circuits, Voltage regulation, square wave Generator, Time delay Circuits, Level Detectors, Summation device, Sampling Circuits, Zero crossing detector, output devices

UNIT V **[12 hours]**

Comparators: Replica impedance, Mixing Transformers, General equation of phase and Amplitude, Comparators, Realization of ohm, mho, Impedance and offset impedance characteristics, Duality principle, Static amplifier comparator - Rectifier bridge circulations current type, sampling comparator, static phase comparator coincidence circuits type Rectifier phase comparator.

Lab Experiments

1. Fuses
2. Overcurrent protection using Electromagnetic relays
3. Over-Voltage protection using Electromagnetic relays
4. Under-Voltage protection using Electromagnetic relays
5. Over-Voltage protection using Static relays
6. Under-Voltage protection using Static relays
7. Motor Protection relay
8. Operation of Circuit Breaker using PSCAD
9. Capacitive Switching using PSCAD
10. Detection of various types of faults in a simple AC system using PSCAD

TEXT BOOKS:

1. **Switchgear & Protection**- Sunil S.Rao -Khanna Publishers.
2. **Power System Protection & Switchgear**- Badriram&ViswaKharma -TMH.
3. **Fundamentals of Power System protection**- Y G. Painthankar and S R Bhide-PHI publication, 2007.
4. **"Power System Protection, Static Relays with Microprocessor applications"**- T.S. MadavaRao, TMH, Second editon, 2004.
5. **"Protective Relays and Protection"** -VanWarrington A. R. and Van C, Vol, I & II Chapman and Hall, 1968.

REFERENCE BOOKS:

1. **A Course in Electrical Power** - Soni, Gupta &Bhatnagar- 3rd Edition,DhanapatRai publication
2. **Power System Protection & Switchgear** - Ravindarnath& Chandra-New age publications.
3. **Electrical Power** - Dr S. L. Uppal- Khanna Publishers.
4. **"Power System Protection"** - Patra. S.P. Basu. S.K. Choudhari.S. Oxford,and IBH Publications.

VIII SEMESTER

Subject	Intellectual Property Rights	Sub. Code	11HS8GCIPR
Credits	02	L-T-P	2-0-0

Objective

- ability to work in multiple teams to understand Patents, Rights conferred on a Patentee, Copy right and Trademarks leading to improvement in team work and leadership qualities.
- ability to identify, formulate and solve problems on Patent law, the legislative provisions regulating patents, principles and procedure for obtaining patent.
- ability to apply technical concepts of IP related technology to give an insight into IP management, Licensing, Valuation, Audit and other aspects of IP

Unit I **[5 hours]**

Basic principles of IP laws: Introduction, Concept of property, Need for a holistic approach, Constitutional aspects of IP, Evolution of the patent system in UK, US and India, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions.

Unit II **[5 hours]**

Patents: Introduction, Origin and meaning of the term patent, Objective of a patent law, the legislative provisions regulating patents, principles underlying the patent law in India, patentableinvention.Procedure for obtaining patent: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.

Provisional and complete specification: Definition of Specification, Kinds of specification, provisional specification, complete specification, Claims, Conditions for amendment.

Unit III **[5 hours]**

Rights conferred on a patentee: Patent rights, Exception and limitations, Duties of a Patentee.

Transfer of patent: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.

Infringement of patents: Construction of claims and infringement, patents held to be infringed, patents held to be not infringed.

Action for Infringement: Where a suit is to be instituted, procedure followed in the suit, Onus of establishment infringement, Defence by the defendant, The Relief's, Injunction, Damages or account of profits, patent agents, patent drafting, database searching, and Case studies.

Unit IV **[06 hours]**

Copy Right: Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.

Author and Ownership of copy right: Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right.

Infringement of copy right: Acts which constitute infringement, general principle, direct and indirect evidence of copying, Acts not constituting infringements, Infringements in literary, dramatic and musical works, Remedies against infringement of copy right, Case studies.

Unit V **[04 hours]**

Trade Marks: Introduction, Statutory authorities, procedure of registration of trade marks, rights conferred by registration of trade marks, licensing in trade mark, infringement of trade mark and action against infringement.

Text Books:

1. Dr. T Ramakrishna, "**Basic principles and acquisition of Intellectual Property Rights**", CIPRA, NSLIU -2005.
2. Dr.B.L.Wadehhra, " **Intellectual Property Law Handbook**", Universal Law Publishing Co. Ltd., 2002.

References:

1. Dr. T Ramakrishna , "**Ownership and Enforcement of Intellectual Property Rights**" , CIPRA, NSLIU -2005.
2. "**Intellectual Property Law (Bare Act with short comments)**",Universal Law Publishing Co. Ltd.. 2007.
3. "**The Trade marks Act 1999 (Bare Act with short comments)**", Universal Law Publishing Co. Ltd., 2005.
4. "**The Patents Act, 1970 (Bare Act with short comments), as amended by Patents (Amendment) Rules 2006 w.e.f. 5-5-2006**". Commercial law publishers (India) Pvt. Ltd., 2006.
5. Thomas T Gordon and Arthur S Cookfair, "**Patent Fundamentals for Scientist and Engineers**", CRC Press 1995.
6. PrabuddhaGanguli, "**Intellectual Property Rights**", TMH Publishing Co. Ltd, 2001

Subject	PROJECT MANAGEMENT	Sub. Code	11HS8GCPRM
Credits	02	L-T-P	2-0-0

Objectives

- ability to design, conduct and analyze projects, track costs and time expenditures, manage quality and risk, evaluate human resources requirements and overcome potential obstacles
- ability to work in multiple teams to perform one common characteristic – the projection of ideas and activities into new endeavors.
- ability to identify, control and coordinate the complex and diverse activities of modern industrial and commercial projects.

UNIT I **(06 Hours)**

Introduction – Definitions – classifications – project risk – scope

UNIT II **(05 Hours)**

Project planning – scope – problem statement – project goals – objectives

UNIT III **(05 Hours)**

Project implementation – project resource requirements – types of resources– men – materials – finance

UNIT IV **(05 Hours)**

Project monitoring – evaluation – control – project network technique –planning for monitoring and evaluation – project scheduling.

UNIT V **(05 Hours)**

Project team management – recruitment – organizing – human resources –team operating rules – project organization – various forms of projectorganizations.

TEXT BOOKS:

1. Project Management – for 21st Centrury-Beenet P Lientz, KathynPrea-Academic Press, 1995
2. Project Management –Denislok

REFERENCE BOOKS:

1. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
2. Project Management – Gopalakrishnan – Mcmillan India Ltd.
3. Project Management-Harry-Maylor-Peason Publication