ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

AFFILIATED INSTITUTIONS

REGULATIONS – 2008

CURRICULUM AND SYLLABI FROM

V SEMESTER

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER V

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EC2311	Communication Engineering	3	0	0	3
2.	EC2312	Digital Signal Processing	3	1	0	4
3.	CS2311	Object Oriented Programming	3	0	0	3
4.	EE2301	Power Electronics	3	0	0	3
5.	EE2302	Electrical Machines II	3	1	0	4
6.	EE2303	Transmission & Distribution	3	1	0	4
PRACTICAL						
1.	CS2312	Object Oriented Programming Laboratory	0	0	3	2
2.	GE2321	Communication Skills Laboratory	0	0	4	2
3.	EE2304	Power Electronics Laboratory	0	0	3	2
4.	EE2305	Electrical Machines II Laboratory	0	0	3	2
		TOTAL	**18**	**3**	**13**	**29**

EC2311 COMMUNICATION ENGINEERING L T P C
3 0 0 3

AIM

To introduce the concepts of communication systems engineering using wire and wireless medium

OBJECTIVES

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I ANALOG COMMUNICATION 9

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II DIGITAL COMMUNICATION 9

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only) 9

Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits) :

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA 9

Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

TOTAL : 45 PERIODS

TEXT BOOKS

1.Taub & Schiling “Principles of communication systems” Tata McGraw hill 2007
2.J.Das “Principles of digital communication” New Age International, 1986

REFERENCES

1. Kennedy and Davis “Electronic communication systems” Tata McGraw hill, 4th edition, 1993.
2. Sklar “Digital communication fundamentals and applications“ Pearson Education, 2001
3. Bary le, Memuschmidt, digital Communication, Kluwer Publication, 2004.
4. B.P.Lathi “Modern digital and analog communication systems” Oxford University Press, 1998.

EC2312 DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

AIM

To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.

OBJECTIVES

- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Fourier transform of discrete sequence – Discrete Fourier series.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial Processors

L = 45 T = 15 TOTAL = 60 PERIODS

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2001.

REFERENCES

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.
2. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", Second Edition, California Technical Publishing San Diego, California. w.DSPguide.com)
4. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

CS2311 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

AIM

To understand the concepts of object-oriented programming and master OOP using C++ and Java.

UNIT I **7**

Object oriented programming concepts – objects-classes- methods and messages-abstraction and encapsulation-inheritance- abstract classes- polymorphism.Introduction to C++- objects-classes-constructors and destructors

UNIT II **12**

Operator overloading - friend functions- type conversions- templates - Inheritance – virtual functions- runtime polymorphism.

UNIT III **8**

Exception handling - Streams and formatted I/O – file handling – namespaces – String Objects - standard template library.

UNIT IV **8**

Introduction to JAVA , bytecode, virtual machines – objects – classes – Javadoc – packages – Arrays - Strings

UNIT V **10**

Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O

TOTAL : 45 PERIODS

TEXT BOOKS

1. B. Trivedi, “Programming with ANSI C++”, Oxford University Press, 2007.
2. Cay S. Horstmann, Gary Cornell, “Core JAVA volume 1”, Eighth Edition, Pearson Education, 2008.

REFERENCES

1. ISRD Group, “Introduction to Object-oriented Programming and C++”, Tata McGraw-Hill Publishing Company Ltd., 2007.
2. ISRD Group, “Introduction to Object-oriented programming through Java”, Tata McGraw-Hill Publishing Company Ltd., 2007.
3. S. B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Premier”, Fourth Edition, Pearson Education, 2005.
4. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, Third Edition, Thomson Course Technology, 2007.
5. K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000.
6. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

EE2301 **POWER ELECTRONICS** **L T P C**
3 0 0 3

AIM

Learning how to apply the electronic devices for conversion, control and conditioning of electronic power.

OBJECTIVES

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologics of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.
- To study simple applications

UNIT I POWER SEMI-CONDUCTOR DEVICES **9**

Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC, BJT, IGBT, MOSFET,- Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR,

UNIT II PHASE-CONTROLLED CONVERTERS **9**

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of cnverters – Dual converters - Battery charger.

UNIT III DC TO DC CONVERTER **9**

Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck-boost converter, concept of Resonant switching - SMPS.

UNIT IV INVERTERS **9**

Single phase and three phase (both 120^0 mode and 180^0 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter.

UNIT V AC TO AC CONVERTERS **9**

Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

TOTAL : 45 PERIODS

TEXT BOOKS

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third edition, New Delhi 2004.
2. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

REFERENCES

1. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition 2003.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

EE 2302 ELECTRICAL MACHINES - II L T P C
3 1 0 4

AIM

To expose the students to the concepts of synchronous and asynchronous machines and analyze their performance.

OBJECTIVES

To impart knowledge on

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 9

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

UNIT II SYNCHRONOUS MOTOR 8

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

UNIT III THREE PHASE INDUCTION MOTOR 12

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

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 7

Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

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

L = 45 T = 15 TOTAL = 60 PERIODS

TEXT BOOKS

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

REFERENCES

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

EE2303 TRANSMISSION AND DISTRIBUTION L T P C
3 1 0 4

AIM

To understand the importance and the functioning of transmission and distribution of the electric power in an electrical utility (or) a power system.

OBJECTIVES

i. To develop expressions for the computation of transmission line parameters.
ii. To obtain the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system.
iii. To analyses the voltage distribution in insulator strings and cables and methods to improve the same.
iv. To understand the operation of the different distribution schemes.

UNIT I INTRODUCTION 9

Structure of electric power system - different operating voltages of generation, transmission and distribution-advantage of higher operating voltage for AC transmission.
An introduction to EHV AC transmission, HVDC transmission and FACTs.
Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters of resistance, inductance and capacitance calculations - single and three phase transmission lines - single and double circuits - solid, stranded and bundled conductors - symmetrical and unsymmetrical spacing – transposition of lines - concepts of GMR and GMD - skin and proximity effects - interference with neighbouring communication circuits.
Corona discharge characteristics – critical voltage and loss.
(Simple diagrams of typical towers and conductors for 400, 220 and 110 kV operations)

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Transmission line classification - short line, medium line and long line - equivalent circuits – Ferranti effect - surge impedance, attenuation constant and phase constant - voltage regulation and transmission efficiency - real and reactive power flow in lines – power circle diagrams – shunt and series compensation.
An introduction to power angle diagram - surge-impedance loading, loadability limits based on thermal loading; angle and voltage stability considerations.

UNIT IV INSULATORS AND CABLES 9

Classification of insulators for transmission and distribution purpose – voltage distribution in insulator string and grading - improvement of string efficiency.
Underground cables - constructional features of LT and HT cables – insulation resistance, capacitance, dielectric stress and grading – tan δ and power loss - thermal characteristics.

UNIT V SUBSTATION, GROUNDING SYSTEM AND DISTRIBUTION SYSTEM 9

Classification, functions and major components of substations.

Bus-bar arrangements - substation bus schemes - single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-a-half with two main buses, double bus-bar with bypass isolators.

Importance of earthing in a substation. Qualitative treatment to neutral grounding and earthing practises in substations.

Feeders, distributors and service mains. DC distributor – 2-wire and 3-wire, radial and ring main distribution. AC distribution– single phase and three phase 4-wire distribution. .

L=45 T = 15 TOTAL =60 PERIODS

TEXT BOOKS

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

REFERENCES

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

CS2311 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

AIM

To understand the concepts of object-oriented programming and master OOP using C++ and Java.

UNIT I 7

Object oriented programming concepts – objects-classes- methods and messages-abstraction and encapsulation-inheritance- abstract classes- polymorphism.Introduction to C++- objects-classes-constructors and destructors

UNIT II 12

Operator overloading - friend functions- type conversions- templates - Inheritance – virtual functions- runtime polymorphism.

UNIT III 8

Exception handling - Streams and formatted I/O – file handling – namespaces – String Objects - standard template library.

UNIT IV 8

Introduction to JAVA , bytecode, virtual machines – objects – classes – Javadoc – packages – Arrays - Strings

UNIT V 10

Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O

TOTAL : 45 PERIODS

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3. S. B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Premier”, Fourth Edition, Pearson Education, 2005.
4. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, Third Edition, Thomson Course Technology, 2007.
5. K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000.
6. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

CS2312	OBJECT- ORIENTED PROGRAMMING LAB	L T P C 0 0 3 2

Aim: To develop object-oriented programming skills using C++ and Java

1. Function overloading, default arguments in C++
2. Simple class design in C++, namespaces, objects creations
3. Class design in C++ using dynamic memory allocation, destructor, copy constructor
4. Operator overloading, friend functions
5. Overloading assignment operator, type conversions
6. Inheritance, run-time polymorphism
7. Template design in C++
8. I/O, Throwing and Catching exceptions
9. Program development using STL
10. Simple class designs in Java with Javadoc
11. Designing Packages with Javadoc comments
12. Interfaces and Inheritance in Java
13. Exceptions handling in Java
14. Java I/O
15. Design of multi-threaded programs in Java

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required
	Hardware Required	
1.	Computers (Pentium-4)	40 Nos with one server
2.	Dot matrix printer	3 Nos
3.	Laser Printer	2 Nos.
4.	UPS (5 KVA)	2
	Software Required	
5.	Turbo C++	40 Nodes
6.	(Java 2 SDK) JDK 5.0 update 6(1.5.0-Internal Version No.)	40 Nos.

GE2321 COMMUNICATION SKILLS LABORATORY L T P C
(Fifth / Sixth Semester) 0 0 4 2
(Common to all branches of B.E / B.Tech Programmes)

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session (Weightage 40%) 24 periods

A. English Language Lab (18 Periods)

1. Listening Comprehension: (6)
Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. Reading Comprehension: (6)
Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. Speaking: (6)

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. Viewing and discussing audio-visual materials (6 periods)

(Samples are available to learn and practice)

1. **Resume / Report Preparation / Letter Writing** (1)
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. **Presentation skills:** (1)
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. **Soft Skills:** (2)
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. **Group Discussion:** (1)
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. **Interview Skills:** **(**1)
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session	**(Weightage – 60%)**	**24 periods**

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. (2)
2. **Presentation Skills:** Students make presentations on given topics. (8)
3. **Group Discussion**: Students participate in group discussions. (6)
4. **Interview Skills**: Students participate in Mock Interviews (8)

REFERENCES:

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth , Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
4. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addision Wesley Longman Ltd., Indian reprint 1998.

Lab Requirements:

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required
1.	**Server**	1 No.
	o PIV system	
	o 1 GB RAM / 40 GB HDD	
	o OS: Win 2000 server	
	o Audio card with headphones (with mike)	
	o JRE 1.3	
2.	Client Systems	60 No.
	o **PIII or above**	
	o **256 or 512 MB RAM / 40 GB HDD**	
	o **OS: Win 2000**	
	o Audio card with headphones (with mike)	
	o JRE 1.3	
3.	**Handicam Video Camera (with video lights and mic input)**	1 No.
4.	Television - 29”	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - **Desirable**	1 No.

EE2304 POWER ELECTRONICS LABORATORY L T P C
0 0 3 2

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

List of experiments with objectives and exercises

1. Characteristics of SCR
2. Characteristics of TRIAC
3. Characteristics of MOSFET and IGBT
4. Transient characteristics of SCR and MOSFET
5. AC to DC fully controlled converter
6. AC to DC half-controlled converter

7. Step down and step up MOSFET based choppers

8. IGBT based single-phase PWM inverter

9. IGBT based three-phase PWM inverter

10. Resonant dc-to-dc converter

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required
1.	Device characteristics (for SCR, MOSFET, TRIAC and IGBT) kit with built in power supply & meters	2 each
2.	SCR firing circuit module	2
3.	Single phase SCR based ½ controlled converter & fully controlled converter along with built-in / separate / firing circuit / module and meter	2 each
4.	MOSFET based step up and step down choppers	1 each
5.	IGBT based single phase PWM inverter module	2
6.	IGBT based three phase PWM inverter module	2
7.	IGBT based high switching frequency chopper module with built-in controller	2
8.	Resonant DC-DC conveter module with built in power supply and controller	2
9.	SCR & TRIAC based 1 phase A.C.phase controller along with lamp or rheostat load	4
10.	SCR based V/I commuted chopper module with relevant firing module (separate or built-in)	4
11.	Dual regulated DC power supply with common ground	4
12.	Cathode Ray Oscilloscope	5
13.	Isolation Transformer	5
14.	Single phase Auto transformer	3
15.	Components (Inductance, Capacitance)	3 sets for each
16.	Multi meter	5
17.	LCR meter	3
18.	Rheostats of various ranges	2 sets of 10 value
19.	Work tables	12
20.	DC and AC metes of required ranges	20

EE 2305 ELECTRICAL MACHINES II LABORATORY L T P C
0 0 3 2

AIM

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor.
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required
1.	DC shunt motor coupled three phase alternator	2
2.	Synchronous motor coupled to DC motor	1
3.	Three phase induction motors – Squirrel cage Slip ring	 2 1
4.	DC Shunt motor coupled salient pole three phase alternator	1
5.	Single phase induction motors	2
6.	Inductive board	1
7.	Starter- Three phase induction motor starters Single phase induction motor starters	 1 1
8.	Meters- Voltmeter (AC) Ammeter (AC) Wattmeter (Ipf) Wattmeter (upf)	 15 15 15 30
9.	Single phase auto transformer	2
10.	Three phase auto transformer	4
11.	Rheostats of various range	30
12.	DC panel boards (220V, 36V)	1 each
13.	AC panel board	1
14.	Work tables	12