J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

Ph.D (ELECTRICAL ENGINEERING) Course Work

Session-July-Dec-2019

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits
					THEORY	PRACTICAL	Total	
PHD-100A	Research Methodology	4	0	25	75	-	100	4
PHEL01	Advance Power Electronics Converters	4	0	25	75	-	100	4
PHEL 02	Energy Auditing and Conservation	4	0	25	75	-	100	4
	Total	12	0	75	225	-	300	12

Note: Exam duration will be of 3 hours.

PHD – 100A RESEARCH METHODOLOGY

PhD (Common Subject)

No. of Credits: 4		Sessional:	25 Marks
L | T | P | Total		Theory:	75 Marks
4 | 0 | 0 | 4		Total:	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

- Understand research process in order to plan a research proposal
- Learn methods to devise and design a research set-up
- Plan and perform data collection methods and its analysis
- Conclude research in report writing

Course Outcomes: The research scholar shall be able to

CO1	Plan a research proposal and design the research.
CO2	Collect data through experiments or surveys as per research requirement.
CO3	Understand and apply sampling and sampling distributions.
CO4	Understand and perform quantitative and qualitative data analysis.
CO5	Write research report with proper citations.

Unit 1 **Introduction to Research**: Definition, need and purpose of research, types of research, research process, approaches to research, planning a research proposal, literature review.

Unit 2 **Measurement Scales**: Indexes vs. Scales, Types of Scale, construction of Scale, Bogardus social distance scale, Thurstone Scale, Likert Scale, Semantic Differential Scale, Guttmann Scale.

Unit 3 **Data Collection Methods:** Experiments and Surveys, Experiments: Classical Experiments, Independent & Dependent Variables, Pre Testing & Post Testing, Double Blind Experiment, Subject Selection, Variation on Experiment Design. Survey Research: Topics appropriate for survey research, Guidelines for asking questions, Questionnaire Construction, Strengths & Weakness of Survey Research, Types of Surveys.

Unit 4 **Sampling**: Types of sampling methods: Non Probability Sampling, Probability Sampling, Theory & Logic of Probability Sampling, Sampling Distributions & Estimates of Sampling Error.

Unit 5 **Data Analysis**: Qualitative v/s Quantitative data analysis, Qualitative Data Analysis: Discovering Patterns, Grounded Theory Method, Semiotics, Conversation Analysis, Qualitative Data Processing. Quantitative Data Analysis: Quantification of Data, Univariate Analysis, Bivariate Analysis, Multivariate Analysis, Regression Analysis, Description Analysis. Hypothesis. Multiple Attribute Decision Making.

Unit 6 **Report Writing, Ethical Issues and Outcomes**: Report Preparation, Structure of Report, Report Writing Skills, Citations, Research Papers, Intellectual Property Rights, Plagiarism, Patent, Commercialization, Ethical Issues.

References:

1. Research Methodology by R. Panneerselvam, 2nd Ed. PHI
2. Research Methodology by C.R. Kothari & Gaurav Garg, 3rd Ed. New Age Publishers
3. Research Methodology and Scientific Writing by C. George Thomas, Ane Books
4. The practice of social research by Earl Babbie, 14th Ed. Cengage
5. Multiple Attribute Decision Making, Gwo-Hshiung Tzeng and Jih-Jeng Huang, CRCPress

PHEL 01	ADVANCED POWER ELECTRONIC CONVERTERS	4L:0T:0P	4 Credits

Course Outcomes:

Students will be able to:

1. Analyze the operation of DC to AC converters
2. Understand the concept of space vector modulation
3. Examine and analyze the concept of switched mode power supplies
4. Analyze the working of Resonant converter topologies
5. Design and understand the multilevel inverters and their applications
6. Apply the concept of Advanced power electronic converters in various applications

.

	Syllabus
Unit	**content**
1	• DC to AC converters: Basic operation and working • Pulse width modulated inverters • Single pulse width modulation • Multiple pulse width modulation, • Sinusoidal Pulse width modulation
2	• Advanced Modulation Techniques: • Space Vector Modulation • Space vector transformation • Concept of space vector • Time Averaging of reference vector
3	• SMPS: Modes of operation Push-Pull and Forward Converter Topologies Voltage Mode Control. • Half and Full Bridge Converters
4	• Introduction to Resonant Converters. • Load Resonant Converter. Zero Voltage Switching and zero currentswitching converter Topologies. • Resonant DC Link Inverters
5	• Multi-level inverters, advantages, • configurations: Diode clamped, Flying capacitor and cascaded Multi-level inverters, applications.
6	• Applications of power electronic converter: UPS, Induction heating ,HVDCTransmission system • Few power electronic circuits used in practice for controlling electric drives.DC-DC Converters for various renewable energy conversion. • GATE Driver Circuits

Suggested reading

- Rashid “Power Electronics” Prentice Hall India 2007.
- G. K. Dubey et.al “Thyristorised Power Controllers” Wiley Eastern Ltd., 2005, 06.

- Dewan & Straughen “Power Semiconductor Circuits” John Wiley &Sons., 1975.
- B. K Bose “Modern Power Electronics and AC Drives” Pearson Education (Asia).,2007
- Abraham I Pressman “Switching Power Supply Design” McGraw Hill PublishingCompany.
- Mohan, Undeland and Robbins, “Power Electronics: Converters, Applications and Design”, John’s Wiley and Sons

PHEL 02	Energy Auditing and Conservation

L T P Cr **Sessional-25**
4 0 0 4 **End Sem-75**
Total-100

Course Objectives:-Students will be able to:

1. To revive energy scenario, energy sources, energy utilization and energy efficiency.
2. To understand different terms and types of energy audit.
3. To identify energy conservation measures in different sector.
4. To prepare energy audit reports.

UNITS	CONTENT	HOURS
1.	Sources of Energy: Energy resources, Stored & running resources, Non- Conventional energy sources, Necessity of conserving resources, Cogeneration- Types of schemes.	6
2.	Energy in Industries: Energy inputs in industry, Comparison of various energy inputs, use of electric energy in industries for motive power, Electric Water heating, Solar Water heater, Water treatment Plant& Efficient treatment Plant load. Fire fighting Pump loads, Air-conditioning & Refrigeration	8
3.	Transformer Loading/Efficiency analysis Feeder/cable loss evaluation, case study, Reactive Power management-Capacitor Sizing-Degree of Compensation-Capacitor losses, Location-Placement Maintenance ,Case study	6
4.	Energy Audit: Audit, A prerequisite for energy conservation, Principles of Energy Audit, Measurement & measuring devices, Analysis of data, Flow diagram, its use, ABC Analysis	6
5.	Energy conservation in Utilities: Energy conservation in generation, transmission, distribution & utilization, Demand side energy Management, Energy efficient lighting system, Energy efficient drives- critical study & analysis of certain case studies.	6
6.	Economics of Energy Conservations: Energy Conservation: Energy Conservation using energy audit data, Principles of energy conservation in industrial, commercial, domestic agricultural & municipal sectors. Planning, Implementation & monitoring of energy conservation project, payback period calculations.	8

Suggested reading:

1. Sukhatme S.P., 'Solar Energy : Principles of thermal collection and storage' Tata- McGraw Hill
2. Keth & Fetcher, 'Energy Efficiency Handbook' CRC Publication.
3. Sinha H.P., 'Power System- I' Khanna Publication**.**
4. Anthony J. Pansini, Kenneth D. Smalling, .Guide to Electric Load Management., PennwellPub; (1998)
5. Howard E. Jordan, .Energy-Efficient Electric Motors and Their Applications., Plenum PubCorp; 2ndedition (1994)
6. Giovanni Petrecca, .Industrial Energy Management: Principles and Applications., TheKluwer international series -207,1999
7. Handbook on Energy Audit and Environment Management , Y P Abbi and Shashank Jain,TERI,2006

8. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009

Course Outcomes:-Students will be able to:

1. Acquire the background required for engineers to meet the role of energy managers and toacquire the skills and techniques required to implement energy management
2. Identify and quantify the energy intensive business activities in an organization
3. Able to perform Basic Energy Audit in an Organization