

Value added courses by the Physics Department:

- Maintenance and Repair of Household Electrical Appliances - **6 month (4 Credit)**
- Solar Energy System and its Application- **3 month(2 Credit)**

Course- I

Maintenance and Repair of Household Electrical Appliances

Course Objectives

1. To understand the key elements of electrical and electronics appliances.
2. To understand the domestic wiring and layout.
3. To understand the Basic safety practices.
4. To understand the various principles of domestic equipment's.
5. To predict the goodness or age estimation of domestic equipment's.
6. To perform layman checks and rectify minor defects.
7. To troubleshoot the defects of the most common household equipment's.
8. To understand the techniques involved in advanced repairing of household equipment's.

Course Outcomes

By the end of the course, the students will be able to

1. Suggest & do remedial measures in the domestic equipment.
2. Do technical checks with relevant tools and solve the problems.
3. Understand the techniques involved in advanced repairing of household equipment's
4. Repair and maintenance of the basic electrical and electronics appliances.
5. Identification to protective devices.
6. Repair and maintenance of the LED Bulbs, Fan, Iron, TV, Cooler and many

more.

7. Able to do domestic wiring and maintenance.
8. Assemble inverter, LED Bulbs, Fans, TV etc.

Course Syllabus

Credit: 04

THEORY COURSE CONTENTS:

Unit: I- Basic safety practices:

Safety Practices; Fires in electrical Circuits & Precautions, Fire Extinguishers & its types, General Safety of Tools & equipment, Rescue of person who is in contact with live wire, Treat a person for electric shock/ injury, Protective clothing: leather or asbestos gloves, flame proof aprons, flame proof overalls buttoned to neck, cuffless (without folds), trousers, reinforced footwear, helmets/hard hats, cap and shoulder covers, ear defenders/plugs, safety boots, glasses/goggles/visors, Safe working practices: using protective clothing and equipment; putting up and reading safety signs; handle tools in the correct manner and store and maintain them properly; while working with electricity take all electrical precautions like insulated clothing, adequate equipment insulation, use of control equipment, dry work area, switch off the power supply when not required, etc.; safe lifting and carrying practices; use equipment that is working properly and is well Maintained; take due measures for safety while working at heights, etc.

Unit: II- General idea on Various Electrical Measuring Instruments/ Components

Types, Multimeter (Digital/ Analog), Energy meter (Digital/analog), Insulation Tester (Megger), Earth tester. Ammeter, voltmeter, Different types of switches, fuse, thermostat, heating elements, registers, conductors, insulators, capacitors, wires and cables (for up to 15 amp) symbol of various components.

Unit: III- Demonstration of Heating and Magnetic Appliances

Demonstration of Heating Appliances and their applications. (Heating Appliances –type, Working Principle, Uses.) Demonstration of Magnetic

Appliances and their applications (Magnetic Appliances- Type, working principle, uses.)

Unit: IV- Maintenance and Repair of heating and motorised appliances

Identification, working and specification of each part. Repairing for some common problems, replacement of coil, insulators, thermostat etc. for the following:

- (a) Repair & maintenance of room heater.
- (b) Repair & maintenance of electric iron.
- (c) Repair & maintenance of electric stove (Induction), electric kettle.
- (d) Repair & maintenance of ceiling and table fan.
- (e) Repair & maintenance of domestic pump motor.
- (f) Repair & maintenance of water cooler
- (g) Repair & maintenance of washing machine.

Unit: V- Assemble of Some Appliances

Assemble different type of inverters circuit & its measurements. Assemble battery charger circuit used in inverter with protection circuit. Assemble Online/Offline UPS & its measurements. Test, faultfinding & repair of given power supply. (DC to AC converter, Types of inverter, its different blocks & oscillators circuits Battery chargers & its protection circuit. UPS working principles of- line & On line UPS circuit used in UPS.

PRACTICAL

Credit: 04

LIST OF PRACTICALS:

1. To make a chart of different fire extinguishers, and their use, Showing Dos and Don'ts of working with Electricity, Different tools used by a Technician and write their respective use. Identify the tools with actual, Different types of switches, fuse, thermostat, heating elements, conductors, insulators, capacitors, wires and cables (for up to 15 amp) symbol of various components. Identify them in actual.
2. Dismantling, re-assembling and troubleshooting of electric room heater (rod type)
3. Dismantling, re-assembling and troubleshooting of ordinary/automatic electric iron, Immersion Heater, kettle etc.
4. Dismantling, re-assembling and troubleshooting of Table fan and Ceiling fan
5. Testing of burnt/faulty motor like (ceiling fan, 3-phase motor and mixer

motor).

6. Testing of a domestic pump motor before starting, tracing and testing its wiring / panel.
7. Assemble different type of inverters circuit & its measurements. Assemble battery charger circuit used in inverter with protection circuit.

Text Books:

1. The Hindu Speaks on Scientific Facts – General Volume, The Hindu Publication, 2006, Chennai Yen, Yetharku, Yeppadi (Tamil) – Sujatha, Vikadan Pirasuram, 2005, Chennai
2. Complete Guide to Home Appliance Repair – Evan Powel, Better Homes and Garden Books Pubn, (Amazon online purchase) 2019

Reference Books:

1. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer
2. Hand Book on Home Appliances – L.Palaniappan, S.P. Publications, Chidambaram, TN. 1st Edition, 2019. ISBN No. 978-93-5351-441-9
3. Troubleshooting and Repairing Major Appliances – Eric Keinert, McGraw- Hill Professional Publishers 2014, New Delhi.
4. Handbook Of Repair And Maintenance Of Domestic Electronics Appliances by Shashi Bhushan Sinha , January 2016.
5. How to Diagnose and Fix Everything Electronic, Second Edition by Michael Jay Geier.
6. Modern Digital Inverter Intro, Servicing & T/S by Manahar Lotia.

Course- II

Solar Energy System and It's Application

Course Objectives

1. To understand the key elements solar energy.
2. To understand the application of solar energy.
3. To have knowledge of solar power systems maintenance and management.
4. To get an exposure to different cell technologies for installation

Course Outcomes

By the end of the course, the students will be able to

1. Understand, maintenance and try to set up solar cell.
2. Understand, maintenance and try to set up photovoltaic solar cell.
3. Understand to use software tools for design of solar thermal system.
4. Understand to use software tools for design of solar photovoltaic systems, case studies.

Course Syllabus **THEORY**

Credit: 02

COURSE CONTENTS:

Unit: I-BASIC INTRODUCTION:

Radiation of heat, Sun-Earth geometric relationship, Layers of the sun, Earth-Sun angles and their relationships, solar energy reaching the earth's surface.

UNIT-II- SOLAR CELL:

Photo- electric effect, Work function energy, cut of frequency, Solar cell, and Module, Panel and array construction, Theory of solar cell. Energy band diagrams, Junction current, solar cell equivalent circuit, IV Characteristics, Efficiency of Solar cell.

UNIT III - SOLAR PHOTOVOLTAIC SYSTEM:

Design of photovoltaic off-grid and grid- connected power systems. Design of system components - PV modules, batteries, charge controllers, inverters, auxiliaries. Performance analysis of a photovoltaic system. Using software codes for design of solar thermal and photovoltaic systems.

UNIT- IV- PERFORMANCE ANALYSIS

Performance analysis of various solar thermal systems, PV system and evaluation of solar thermal energy storage system, selection of components and materials, estimation of economics. Using software tools for design of solar thermal and photovoltaic systems, case studies.

UNIT V - ENERGY OPTIMIZATION:

Case studies of energy system optimization – Application - Analysis and design of solar thermal and photovoltaic systems.

Text books:

1. Solar Cells: Operating Principles, Technology and System Applications, Martin Green Published by the University of New South Wales, 1980 (Required) available at the BU Barnes and Noble book store
2. Solar Engineering of Thermal Processes, Third Edition, John A. Duffie and William A. Beckman, John Wiley and Sons. Inc. 2005 (Chapters 1, 2,3, and 7) Recommended www.pveducation.org

Reference Books:

1. Photovoltaic Science and Engineering Handbook, Second Edition, Antonio Luque and Steven Hegedus, John Wiley and Sons, 2012
2. Thin film Solar Cells, Jeff Poortmans and Vladimir Arkhipov (Ed) John Wiley and Sons Ltd. 2006
3. Solar Cell Device Physics, Second Edition, Stephen J. Fonash, Elsevier, Inc., 2010
4. Solar Electricity, Second Edition, Thomas Markvart (Editor), John Wiley and Sons, Ltd., 2000,
5. Photovoltaic Engineering Handbook, F. Lasnier and T. G. Ang, IOP Publishing UK (Adam Hilger USA) 1990, ISBN 0-85274-311-4
6. Solar energy: fundamentals, design, modeling and application by G.N.tiwari
7. Planning and Installing Photovoltaic Systems - A guide for installers, architects and engineers Second Edition, Earth scan publishing (2008)
8. Non-Conventional Energy Resources by B.H. Khan.