STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

BACHELOR OF VOCATIONAL (B.Voc.) PROGRAMME
SUSTAINABLE ENERGY MANAGEMENT

SYLLABUS
(Effective from the academic year 2016 – 2017)

FUNDAMENTALS OF PHOTOVOLTAICS

CODE:16VS/VM/PV26

CREDITS: 6
L T P: 3 0 3
TOTAL TEACHING HOURS: 78

OBJECTIVES OF THE COURSE

- To learn about Photovoltaic technology principles
- To get an insight about techniques and applications of solar cells.

Unit 1 **(12hrs.)**

Photovoltaic Basics and Photovoltaic Cells

1.1 Semiconductor basics– properties-Theory of Photovoltaic systems - energy levels – Photo Conductivity

1.2 PN junction: homo and hetro junctions – metal semiconductor interface- Dark and illumination characteristics - figure of merit– efficiency of solar cells

Unit 2 **(9hrs.)**

Classification of Photovoltaic Systems

2.1 Stand-alone Systems - Systems with Battery Storage -System with Back-up - Generator Power - System Connected to the Utility Grid - Hybrid Systems

2.2 System components - PV arrays – inverters –batteries - charge controls - net power meters.

Unit 3 **(9hrs.)**

Photovoltaic System Design

3.1 Solar cell array: System analysis and performance prediction- Shadow analysis - reliability - design concepts of solar array

3.2 Design of solar PV systems and cost estimation - Home lighting and other appliances

Unit 4 **(9hrs.)**

Photovoltaic System Applications

4.1 Building-integrated photovoltaic units

4.2 Solar cars – aircraft - space solar power satellites.

Unit 5 **(39hrs.)**

Case Study

5.1 Solar energy to electric energy conversion – Experiment using Solar panel.

5.2 Efficiency of Solar panel calculation over the day with the use of meters.

5.3 Measurement of Sun’s Radiation on Earth’s Surface

5.4 Computer simulated experiment on Energy Consumption in a building

BOOKS FOR STUDY AND REFRENCE

Alan L Fahrenbruch and Richard H Bube. *Fundamentals of Solar Cells: PV Solar Energy Conversion,* Academic Press, 1983.

Garg H P. Prakash J. *Solar Energy: Fundamentals & Applications*, Tata McGraw Hill, 2000.

Larry D Partain, *Solar Cells and their Applications*, John Wiley and Sons, Inc, 1995.

Raj. G.D. *Non-Conventional Sources of Energy*, Khanna Publishers, 2009

PATTERN OF EVALUATION

Continuous Assessment : 25 Marks

End Semester Examination (Total 100 marks will be converted to 75 marks)

Theory :50 Marks Practical :50 Marks

Total Marks: 100 Duration: 6 hours

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

BACHELOR OF VOCATIONAL (B.Voc.) PROGRAMME
SUSTAINABLE ENERGY MANAGEMENT

SYLLABUS
(Effective from the academic year 2016 – 2017)

ENERGY CONVERSION TECHNIQUES

CODE:16VS/VM/ET26

CREDITS: 6
L T P: 3 0 3
TOTAL TEACHING HOURS: 78

OBJECTIVES OF THE COURSE

- To analyze the conventional energy conversion techniques
- To develop understanding on direct energy conversion systems
- To appreciate the need and necessity of energy storage systems and their desirable characteristics

Unit 1 **(8hrs.)**

Introduction

1.1 Introduction – energy conversion – conventional techniques.
1.2 Reversible and irreversible cycles.

Unit 2 **(10hrs.)**

Direct Conversion of Thermal to Electrical Energy

2.1 Thermoelectric Converters – thermoelectric refrigerator – thermoelectric generator
2.2 Thermionic converters – Ferro electric converter – Nernst effect generator – thermomagnetic converter.

Unit 3 **(11hrs.)**

Chemical, Electrochemical Energy and Hydrogen Energy Generation

3.1 Batteries – types – working – performance governing parameter
3.2 Dye sensitized solar cells - Quantum dots sensitized solar cells
3.3 Photo catalysis – Photo electro catalysis-Photo bio synthesis-Bio reactors-Water splitting-Hydrogen generation

Unit 4 **(10hrs.)**

Energy Storage Systems

4.1 Introduction – storage of mechanical energy, electrical energy, chemical energy thermal energy.
4.2 Electrochemical energy storage – super capacitor- pseudo capacitor- ultra capacitor.

Unit 5 **(39hrs.)**

Case Study

5.1 Types of batteries-Chemical Energy to Electrical Energy
5.2 Conversion of Solar Energy to Heat Energy- Solar Water heater
5.3 Conversion of Solar Energy to Electrical Energy-Solar Water pump

BOOKS FOR STUDY AND REFRENCE

Archie.W.Culp. *Principles of Energy Conversion*, Singapore: McGraw-Hill Inc., 1991,

Kordesch. K. and Simader.G. *Fuel Cell and Their Applications*, Germany: Wiley-Vch, 1996

Kettari, M.A. *Direct Energy Conversion*, Addison-Wesley Pub. Co. 1997

Hart A.B and Womack. G.J. *Fuel Cells: Theory and Application*, London: Prentice Hall, Newyork Ltd., 1989

PATTERN OF EVALUATION

Continuous Assessment : 25 Marks

End Semester Examination (Total 100 marks will be converted to 75 marks)

Theory :50 Marks Practical :50 Marks

Total Marks: 100 Duration: 6 hours

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

BACHELOR OF VOCATIONAL (B.Voc.) PROGRAMME
SUSTAINABLE ENERGY MANAGEMENT

SYLLABUS
(Effective from the academic year 2016 – 2017)

ENERGY MANAGEMENT AND ENERGY AUDIT

CODE:16VS/VE/EM25

CREDITS: 5
L T P: 5 0 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To understand energy management.
- To get an insight of energy audit and energy conservation practices.

Unit 1 **(13hrs.)**

Introduction

1.1 Basic needs of energy management and ethics - Ecological issues - sustainable energy for future.

1.2 Energy scenario – Principles of energy conservation - Commercial and noncommercial energy - primary energy resources - commercial energy production - final energy consumption.

Unit 2 **(13hrs.)**

Energy Management

2.1 Industrial energy management systems: Energy monitoring and targeting – Elements – data - information analysis and techniques

2.2 Energy consumption – production - Energy Management Information Systems (EMIS) - Economics of energy conservation schemes

Unit 3 **(13hrs.)**

Energy Policy and Security

3.1 Global Energy issues - National and state level energy issues - National and State energy policy - Industrial energy policy - Energy security - Energy vision

3.2 Energy policy and energy labeling - Energy pricing and impact of Global variations - Energy policy issues - Energy security - Role of energy managers in industries

. **Unit 4** **(13hrs.)**

Economic Analysis

4.3 Introduction: Economic concepts - Measures of economic performance – Procedure for economic analysis.

4.4 Investment cost – Procedure for optimized system selection and design – Load curves - Sensitivity analysis.

Unit 5 **(13hrs.)**

Energy Conservation Principles

5.1 Indian energy scenario - Sector-wise energy consumption. Energy needs of growing economy - Long term energy scenario.

5.2 Energy audit questionnaire – Regulatory measures - Energy conservation Acts.

BOOKS FOR STUDY AND REFRENCE

Jacob. *"Energy Policy*", Nova publisher, 2009.

Smith. C.B. *Energy "Management Principles",* Pergamon Press, 2006.

Subhes C. Bhattacharyya. *"Energy Economics*", Springer 2011.

Trivedi, P.R. and Jolka K.R. *"Energy Management*", Common Wealth Publication, 2002.

White, L. C. *"Industrial Energy Management and Utilization*", Hemisphere Publishers, 2002.

PATTERN OF EVALUATION

Continuous Assessment : 25 Marks

End Semester Examination (Total 100 marks will be converted to 75 marks)

Total Marks: 100 Duration: 3 hours

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

BACHELOR OF VOCATIONAL (B.Voc.) PROGRAMME

SYLLABUS

(Effective from the academic year 2016 – 2017)

ENVIRONMENTAL STUDIES

CODE: 16VS/UC/ES22 **CREDITS : 2**

L T P : 2 0 0

TOTAL TEACHING HOURS : 26

OBJECTIVES OF THE COURSE

- To create an awareness about current environmental issues
- To educate students on conservation and management of natural resources
- To encourage students to be ecosensitive and ecofriendly

Unit 1

Introduction 6hrs.)

1.1 Components of the Environment – Classification and Characteristics of Resources – Renewable and Non – Renewable Resources

1.2 Need for Public Awareness in Conservation of Natural Resources

1.3 Energy Flow in Ecosystems – Aquatic and Terrestirial – Food Chain and Food Web

Unit 2

Pollution and Socio Economic Aspects of the Environment (10hrs.)

2.1 Types of Pollution – Air, Water, Solid Waste, Noise

2.2 Problems - Green House Effect – Depletion of the Ozone Layer – Climate Change

2.3 Bio Diversity - Definition - Loss of Bio Diversity – Threats to Biodiversity and Conservation of Biodiversity

2.4 Human Behaviour: - Population – Urbanization – Poverty (As Cause and Result of Pollution and Degradation)

2.5 Technology: Agriculture and Industry – Deforestation. Misuse and Abuse of the Resources

2.6 Effects and Consequences of Environmental Problems

Unit 3

Sustainable Development, Remedies and Policy Implications (10 hrs.)

3.1 Environmental Disasters Natural and Human Made – Bhopal Gas Tragedy – Chernobyl Accident – Fukushima Nuclear Crisis - Gulf War – Love Canal Episode – Tsunami – Volcanic Eruptions

3.2 Methods Evolved to Measure and Check Environmental Degradation and Pollution – Carbon Footprint, Carbon Credit, Ecological Footprint, and Ecological Shadow

3.3 Environmental Movements in India – Chipko Movement, Narmada Bachao Andolan, Sethu Samudram Project

3.4 Environmental Acts – Policy Measures with respect to India

3.5 International Environmental Agreement – Stockholm Conference – Montreal Protocol – Rio Meet – Kyoto Conference – UN Conference on Climate Change (Copenhagen)

Field visit

Eco initiatives at the campus: Garbage Segregation and Vermicomposting – Greywater Recycling – Rainwater Harvesting – Solar Powered Lights – Biodiversity

TEXT BOOK

Bharucha, E. *Textbook of Environmental Studies***.** Hyderabad: Universities Press, 2005.

REFERENCE BOOKS

Ignacimuthu, S. *Environmental Awareness and Protection***.** New Delhi: Phoenic House, 1997.

Jadhav, H and V. M. Bhosale. *Environmental Protection and Law.* New Delhi: Himalaya, 1995.

Odum, E.P. *Fundamentals of Ecology***.** U.S.A: W.B. Sauders, 1971.

Mies, M and V. Shiva. *Ecofeminism*, London: Zed Books, 1989.

Singh, H.R. *Environmental Biology***.** New Delhi: S.Chand, 2005.

PATTERN OF EVALUATION

Continuous Assessment: (Totally internal)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

BACHELOR OF VOCATIONAL (B.Voc.) PROGRAMME

SYLLABUS
(Effective from the academic year 2016 – 2017)

CIVIC AWARENESS

CODE: 16VS/US/CA22 **CREDITS : 2**

OBJECTIVES OF THE COURSE

The students will educate targeted groups on saving energy and methods of using sustainable source of energy

As part of the program, the students will assess the needs of a particular building and offer suggestions on optional use of energy.