

Lecture Plans

DEPARTMENT OF RENEWABLE ENERGY ENGINEERING

College of Technology and Engineering, MPUAT, Udaipur

Course Code: RES 511

Cr. Hr. 3(2+1)

Course Title: Solar Energy Utilization

Course Teacher : Dr. N. L. Panwar

1. Introduction to sun and its characteristics, Structure of the Sun.
2. Extraterrestrial solar radiation, the solar constant.
3. Solar radiation at earth's surface, beam and scattered radiation and air mass.
4. Introduction to extraterrestrial radiation, diffuse radiation, attenuation of beam and diffused radiation at the ground.
5. Basic Sun Earth Angles, solar time and the equation of time, Day length.
6. Solar energy measuring instruments, pyranometer, pyrheliometer, sunshine recorder.
7. Estimation of average solar radiation, ratio of beam and total radiation on tilted surface of that on horizontal surface.
8. Introduction of Flat plate collector.
9. Design and constructional parameters of flat plate collector and their properties.
10. Thermal Analysis of Flat-plate Collector.
11. Assessment of Useful Heat Gained by the fluid.
12. Estimation of fin efficiency
13. Estimation of collector efficiency factor
14. Estimation of Heat Removal Factor.
15. Focusing collectors, types and applications of focusing collectors
16. Introduction and principle of operation of solar cooker.
17. Introduction and principle of operation of solar air heater.
18. Introduction and principle of operation of solar water heater.
19. Introduction and principle of operation of solar distillation.
20. Introduction and principle of operation of solar pond.
21. Introduction and principle of operation of solar thermal power generation.
22. Introduction and principle of operation of solar greenhouse.
23. Introduction and principle of operation of solar PV system.
24. A basic description of an energy storage system.
25. Introduction and principle of thermal energy storage.
26. Introduction and principle of electrical energy storage.
27. Introduction and principle of chemical energy storage.
28. Introduction and principle of hydro –storage.

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College of Technology and Engineering, MPUAT, Udaipur

Course Code: REE 535

Cr. Hr. 3(2+1)

**Course Title: Direct Energy Conversion
Technology**

Course Teacher : Dr. N. L. Panwar

1. Basic Science of Energy Conversion.
2. Physics of semi-conductor junctions for photo-voltaic conversion of solar energy.
3. Solar cell, types of solar cell modules, components of SPV system.
4. Fabrication and energy assessment of solar cell.
5. Introduction and principle of diode.
6. Details of blocking diode.
7. Charge controller, inverter and batteries used.
8. Application of solar cell in photo-voltaic power generation system.
9. Thermo-dynamics and performance photo-voltaic power generation system
10. Power output and conversion efficiency of photo-voltaic system.
11. Advantages and disadvantages of photo-voltaic solar energy conversion.
12. Design of photo-voltaic systems for domestic lighting.
13. Design of photo-voltaic systems for irrigation application.
14. Design of photo-voltaic systems for grid application.
15. Technologies and physics of thermo-electric generators.
16. Introduction and principle of Thermo-electric effects
17. Thermo-electric materials and optimization studies.
18. Basic concepts and design consideration of MHD generators.
19. Cycle analysis of MHD system.
20. Power output and conversion efficiency of MHD system.
21. Thermo ionic power conversion and plasma.
22. Power output and conversion efficiency of thermo ionic power system.
23. Introduction and principle of fuel cells.
24. Classification of fuel cells.
25. Thermo-dynamics and performance of fuel cells and their applications.
26. Power output and conversion efficiency of fuel cells.

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DEPARTMENT OF RENEWABLE ENERGY ENGINEERING

College of Technology and Engineering, MPUAT, Udaipur

Course Code: REE 512

Cr. Hr. 3(2+1)

**Course Title: Bio-Energy Conversion and
Processing of Wastes**

Course Teacher : Dr. N. L. Panwar

1. Introduction, Wastelands for energy plantation.
2. Classification of waste land and their use through energy plantation.
3. Selection of species, methods of field preparation, and transplanting.
4. Harvesting of biomass and coppicing characteristics.
5. Classification of biomass.
6. Physio-chemical characteristics of biomass.
7. Higher and lower heating value solid, liquid and Gaseous fuels.
8. Introduction and principle of physical conversion of biomass.
9. Introduction and principle biochemical conversion of biomass.
10. Introduction and principle of biodiesel production.
11. Introduction and principle of alcohol production.
12. Vehicular application of biodiesel.
13. Vehicular application of alcohol.
14. Introduction of thermo chemical conversion of biomass.
15. Principle and classification of gasifiers.
16. Design of biomass gasifier.
17. Application of gasifiers for thermal and electric power generation
18. Cleaning and cooling of producer gas.
19. Design of wood gas stove.
20. Design of improved cookstoves.
21. Utilization of agro residues for energy production.
22. Introduction and principle of densification.
23. Introduction and principle of pyrolysis.
24. Properties and applications of pyrolytic oil.
25. Introduction of dendro thermal power generation.
26. Introduction of direct combustion.
27. Design of open combustion furnaces for industrial applications.
28. Greenhouse gas mitigation potential through biomass.

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DEPARTMENT OF RENEWABLE ENERGY ENGINEERING

College of Technology and Engineering, MPUAT, Udaipur

Course Code: REE 613

Cr. Hr. 3(2+1)

Course Title: Thermo chemical Conversion of Biomass **Course Teacher : Dr. N. L. Panwa**

1. Introduction of Thermo chemical degradation.
2. History of small gas producer Engine system.
3. Chemistry of gasification.
4. Gasifier – type, operating principle.
5. Gasifier fuels, properties, preparation.
6. Conditioning of producer gas.
7. Application of producer gas for shaft power generation
8. Thermal application of producer gas.
9. Thermodynamic assessment of gasification system.
10. Economic evaluation of gasification system.
11. Introduction and principle of combustors.
12. Design principle of wood burning stoves
13. Construction and operation of wood burning stoves.
14. Introduction and principle Pyrolysis.
15. Classification of pyrolysis plant.
16. Operation and product recovery from pyrolysis plant.
17. Introduction of incineration and plant lay out.
18. Introduction and principle of co-generation plant.
19. Co-generation plant – type, layout.
20. Energy recovery through Co-generation plant
21. Instruments related to thermochemical conversion.

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DEPARTMENT OF RENEWABLE ENERGY ENGINEERING

College of Technology and Engineering, MPUAT, Udaipur

Course Code: REE 231

Cr. Hr. 3(2+1)

Course Title: Fundamental of Renewable

Course Teacher : Dr. N. L. Pnawar

Energy Sources

1. Introduction to renewable power sources.
2. Indian energy scenario and global renewable power potential.
3. Energy consumption pattern in Indian agriculture.
4. Comparing Renewable Wind Energy to Non renewable Energies
5. Introduction to ocean energy
6. Solar Energy Basics.
7. Solar radiation theory.
8. Fundamental of Solar collectors
9. Solar PV system design
10. Solar Energy and Advanced Technologies.
11. Solar Electricity: Potential and Generation
12. Numerical problems related to SPV power generation
13. Environmental Impact and economics of Solar PV system
14. Basic concepts wind energy
15. Different wing machine for power generation.
16. Torque determination in different wind machine.
17. Power estimation and application of wind mill.
18. Numerical problems related to wind power generation
19. Wind energy and environmental Impacts.
20. Introduction of thermo chemical conversion of biomass.
21. Principle and classification of gasifiers.
22. Design of biomass gasifier.
23. Application of gasifiers for thermal and electric power generation
24. Numerical problems related to gasification-based power generation
25. Dendro thermal power generation.
26. Environmental issues and techno economics of biomass gasification technology.
27. Introduction biogas technology and mechanisms.
28. Study of different biogas plant
29. Factor affecting biogas generation
30. Design of biogas plant for different feedstock.
31. Biogas and environmental issues
32. Numerical problems related to biogas power generation.

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DEPARTMENT OF RENEWABLE ENERGY ENGINEERING

College of Technology and Engineering, MPUAT, Udaipur

Course Code: REE 321

Cr. Hr. 3(2+1)

Course Title: **Bio-Energy systems: Design and Applications**

Course Teacher : **Dr. N. L. Panwar**

1. Introduction to fermentation process and its requirement.
2. Aerobic and anaerobic fermentation.
3. Industrial application of fermentation process.
4. Classification of anaerobic digester.
5. Heat transfer in anaerobic digester.
6. Introduction to land fill technology.
7. Potential and scope of land fill technology in Indian context
8. Introduction to Wastelands for energy plantation.
9. Classification of waste land and their use through energy plantation.
10. Selection of species, methods of field preparation, and transplanting.
11. Harvesting of biomass and coppicing characteristics.
12. Classification of biomass.
13. Physio-chemical characteristics of biomass.
14. Higher and lower heating value solid, liquid and Gaseous fuels.
15. Introduction and principle of physical conversion of biomass.
16. Introduction of thermo chemical conversion of biomass.
17. Preparation of fuel for gasifier.
18. Principle and classification of gasifiers.
19. Design of biomass gasifier.
20. Application of gasifiers for thermal and electric power generation
21. Cleaning and cooling of producer gas.
22. Utilization of agro residues for energy production.
23. Introduction and principle of densification.
24. Introduction and principle of pyrolysis.
25. Properties and applications of pyrolytic oil.
26. Introduction of dendro thermal power generation.
27. Design of open combustion furnaces for industrial applications.
28. Greenhouse gas mitigation potential through biomass.
29. Introduction and principle biochemical conversion of biomass.
30. Introduction and principle of biodiesel production.
31. Introduction and principle of alcohol production.
32. Vehicular application of biodiesel.
33. Vehicular application of alcohol.