

# 19AG215 FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Hours Per Week :

L	T	P	C
2	0	2	3

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
30	0	30	10	45	-	-	-	-



Source :

[https://lh3.googleusercontent.com/04SVigB2G84tTzk\\_2erOV\\_DmyakvO1ZyGxBQYR\\_WNc9uAl5J2koWr\\_cg6C690i\\_rBdv5xa1Ow=s170](https://lh3.googleusercontent.com/04SVigB2G84tTzk_2erOV_DmyakvO1ZyGxBQYR_WNc9uAl5J2koWr_cg6C690i_rBdv5xa1Ow=s170)

## COURSE DESCRIPTION AND OBJECTIVES:

The main objective is to make the student aware of the various basic aspects of energy and their uses and impart knowledge about the different classifications of energy sources and major renewable energy sources and technologies. To familiarize the students with different bioenergy sources and production technology.

## COURSE OUTCOMES:

Upon completion of the course, student will able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Identify and understand the fundamentals of renewable energy sources and the use of renewable energy for agricultural applications.	2
2	Ability to understand and analyze the principle of construction and working of the various renewable energy devices.	2
3	Recognize the need of renewable energy sources in agriculture and analyzing the usage and maintenance of different renewable energy devices.	11
4	Ability to design and development of solar water heater, solar cooker, windmill, biogas plant and gasifier.	2
5	Ability to apply renewable energy sources in agriculture energy sector.	1

## SKILLS:

- ✓ Identify various renewable energy sources.
- ✓ Design and development of a solar water heater and solar cooker.
- ✓ Production of biogas and producer gas.
- ✓ Differentiate various biogas plants and gasifiers.

- UNIT - I** **L-6**  
Introduction to energy: Classification-Energy and environment- Concept of Renewable Energy Sources (RES)-Clean Development Mechanism-Role of renewable energy for mitigation of Global warming, Classification of RES - Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources. Energy inputs for agricultural production.
- UNIT - II** **L-6**  
Solar energy: Fundamentals and basic principles- Solar radiation measurement, Basic Principles of Solar thermal energy conversion, Flat plate and Concentrating collectors, different solar thermal devices, Applications and gadgets- Solar drying, Solar still Solar Photo voltaic electricity production: Principles of Photo voltaic energy production-p-n junctions, Solar cells, PV Systems- Cell characteristics.
- UNIT - III** **L-6**  
Wind energy: Energy available in wind, General formula, Lift and drag. Basics of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Power coefficient-Betz limit-Operational parameters of wind turbines-torque coefficient-tip speed ratio. Types of wind turbine rotors, Working principle of wind power plant.
- UNIT - IV** **L-6**  
Bio-energy: Thermo-chemical energy conversion of biomass – Biomass combustion- Combustion of Biomass and stoves. Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification - Types of gasifiers, construction and working of different types of gasifiers, various types of biomass cook stoves for rural energy needs.
- UNIT - V** **L-6**  
Biochemical energy conversion of biomass: Anaerobic digestion process-types of biogas plants-Basic design aspects of Biogas plants-operational and environmental parameters affecting biogas generation and usages, advantages and disadvantages of biogas plant slurry. Liquid bio-fuels. Basic principles for the production of alcohol and biodiesel.

### LABORATORY EXPERIMENTS

#### LIST OF EXPERIMENTS

**TOTAL HOURS: 30**

1. Estimation of energy input in agricultural production.
2. Study of carbon foot print estimation
3. Estimation of the calorific value of fuels.
4. Study of solar water heating system.
5. Study of solar cookers.
6. Study of different types of solar dryers.
7. Solar drying experiment.
8. Study of a lab scale floating gas holder type biogas plant.
9. Design of biogas plant.
10. Study of an improved biomass stove.
11. Study of a biomass gasifier.
12. Study of solar photovoltaic cell characteristics.
13. Estimation of solar energy availability at a locality.
14. Visit to renewable energy power production facilities.
15. Practical examinations.

#### TEXT BOOK :

1. G.D.Rai,2013, "Non-Conventional Energy Sources", Khanna Publishers, Delhi. 2013.

#### REFERENCE BOOKS:

1. Mathur, A.N and Rathore N.S. 1992,"Biogas production, management and utilization". Himanshu Publication. Delhi.
2. Rathore N. S., Kurchania A. K. and Panwar N. L. 2007. "Non-Conventional Energy Sources", Himanshu Publications.
3. Rathore N. S., Kurchania A. K. and Panwar N. L. 2007. "Renewable Energy, Theory and Practice", Himanshu Publications.
4. Sukhatme, S.P and Nayak, J.K 2010, "Solar Energy: Principles of Thermal Collection and Storage", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi.
5. Tiwari, G. N and Ghoshal, M. K 2005, "Renewable Energy Resources: Basic Principles and Applications". Narosa Pub. House. Del.