reports.

Essential/recommended readings

1. Anthony Esposito, “Fluid Power with Applications”, 7th Edition, published in February , 2024.
2. Majumdar S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata McGrawHill, July 2017.
3. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.
4. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.

Suggestive readings

1. Majumdar S.R., “Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995
2. Michael J, Prinches and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989.
3. Shanmugasundaram.K, “Hydraulic and Pneumatic controls”, Chand & Co, 2006
4. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time

DISCIPLINE ELECTIVE COURSE –: Sustainable Energy Technologies (INDSE8G)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Sustainable Energy Technologies (INDSE8G)	04	02	-	02	Course admission eligibility	Basics Knowledge of Physics

Learning Objectives

The Learning Objectives of this course are as follows:

- To provide sound knowledge about different sustainable resources.

- Discussion of different types of solar thermal systems and solar photovoltaic systems.
- To have adequate knowledge of construction and working of various types of wind energy systems and micro-hydro power systems
- To have sound knowledge about bioenergy systems

Learning Outcomes

After successful completion of the course, students will be able to:

- Acquire the knowledge about sustainable energy and its different types
- Be conversant in construction and working of concentrated solar power systems and Solar Photovoltaic systems
- Be conversant in construction and working of different wind energy systems and different micro-hydro systems.
- Understand different bio-energy systems

SYLLABUS OF DSE

UNIT – I **(8 hours)**

Introduction to sustainable energy and Energy Fundamentals: Sustainable energy, Alternative energy sources: Primary, secondary and tertiary sources, Introduction to different types of sustainable energy resources-solar energy, wind energy, water energy and biomass energy.

UNIT – II **(8 hours)**

Classification of Solar Photovoltaic systems: Grid connected, off-grid, stand-alone systems. Photovoltaic cells: Types, merits and demerits, Different types of panels, Battery and other accessories, Recent trends and promotional schemes

UNIT – III **(8 hours)**

Wind energy systems and Micro-hydro Power systems

Types of wind energy systems: Large and small, commercial and domestic, grid connected and stand-alone, Small Horizontal axis and vertical axis wind turbines: construction, working, specifications and maintenance procedure.

Micro hydro power systems**:** Classification, Layout, construction and working, Installation: procedures and precautions, operating procedures and maintenance.

UNIT – IV **(6hours)**

Bio-energy Systems

Classification of biofuels: biogas and biodiesel, Biomass power plants: Layout, construction and principle of working and specification, Applications of various bio-fuels: Domestic and commercial

Practical component: (Hardware/ Software) **(60 hours)**

1. Identify the components of solar flat plate collector.
2. Use pyranometer for measurement of solar radiation flux density.
3. Assemble a solar PV system with and without battery connection.
4. Measure heat output, Maximum power, power output efficiency of solar PV panel.
5. Use vane anemometer for measurement of different locations for site selection for wind mill.
6. Industrial visit
7. Project based on sustainable technologies.
8.

Essential/recommended readings

1. C. S. Solanki, *Solar Photovoltaics*. PHI Learning Pvt. Ltd., 2015.
2. Solar energy, 4th edn , January 2017 by S P Sukhatme and J K Nayak
3. T. Ackermann, *Wind Power in Power Systems*. John Wiley & Sons, 2012.
4. D. P. Kothari, *Renewable Energy Sources and Emerging Technologies*. 2022.
5. V. C. Nelson, *Introduction to Bioenergy*. CRC Press, 2017.

Suggestive readings

1. K. Lovegrove, *Concentrating Solar Power Technology*. Elsevier, 2012.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time

GENERIC ELECTIVE COURSE: Instrumentation and Control (INGE7A)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Instrumentation and Control (INGE7A)	04	03	-	01	Course admission eligibility	Basic instrumentation

Learning Objectives

The Learning Objectives of this course are as follows: