NON-CONVENTIONAL ENERGY SOURCES
SIGNALS AND SYSTEMS

Subject Code : MT601OE
Regulations : R18 - JNTUH
Class : III Year B.Tech EEE II Semester

Department of Electrical and Electronics and Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

NON-CONVENTIONAL ENERGY SOURCES (MT601OE)
COURSE PLANNER

COURSEOVERVIEW:
The main objective of this subject is given below:

- To learn about the various renewable non conventional energy resources that are available in the earth.
- To study about the operation of solar PV system, wind energy conversion system, biomass, wave, tidal and OTEC energy systems.

PREREQUISITES:

Level	Credits	Periods/ Week	Prerequisites
UG	3	4	1. Power Systems

COURSEOBJECTIVES:

At the end of the course, the students will be able to:

- Demonstrate the ability to use basic knowledge in mathematics, science and engineering and apply them to solve problems specific to mechanical engineering (Fundamental engineering analysis skills).
- Design a system to meet desired needs within environmental, economic, political, ethical health and safety, manufacturability and management knowledge and techniques to estimate time, resources to complete project.

COURSE OUTCOME:

S.No	Description	Bloom's Taxonomy Level
CO1	***Understand*** the basic concepts and operation of renewable energy systems	Knowledge, Understand (Level 1, Level 2)
CO2	***Remember*** the ideas and statistics of current RES availability and usage.	Knowledge, Understand (Level 1, Level 2)
CO3	***Analyze*** the problems in RES installation in real time.	Apply (Level 3)
CO4	***Identify*** the other NCES and available sources improvement .	Understand, Apply (Level2, Level 3)
CO5	***Apply*** the renewable energy systems in real time applications.	Understand, Apply (Level 1,Level 3)

1. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**3**	**Lectures, Assignments university exams.**

PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**2**	**Slip tests, Surprise tests and Mock tests**
PO3	**Design/Development Analysis:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**2**	**Hands on Practice sessions**
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**2**	**Lab Sessions and model developments**
PO5	**Modern Toll Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	**2**	**Practices new Soft computing techniques**
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	**2**	**Seminars & Project work**
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	**3**	**--**
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	**-**	**--**
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**-**	**--**
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	**2**	**Seminars, Discussions**
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	**2**	**Develop new projects**
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**2**	**Research**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: None

2. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSO)		**Level**	**Proficiency assessed by**
PSO1	Talented to analyze, design, and implement electrical & electronics systems and deal with the rapid pace of industrial innovations and developments.	**2**	**Lectures, Assignments.**
PSO2	Skillful to use application and control techniques for research and advanced studies in Electrical & Electronics Engineering domain.	**2**	**Participate events, seminars & symposiums**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: None

COURSE CONTENT:
AS PER JNTUH SYLLABUS

UNIT – I
PRINCIPLES OF SOLAR RADIATION
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.
UNIT II
SOLAR ENERGY COLLECTION, STORAGE & APPLICATIONS
Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.
UNIT – III
Solar Energy Storage And Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics..
UNIT –IV
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.
UNIT – V
Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.
GATE SYLLABUS: Not Applicable
IES SYLLABUS: Not Applicable

SUGGESTED BOOKS:
TEXT BOOKS:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.

REFERENCE BOOKS:

1. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing, House, New Delhi, 2004
2. Wakil MM, *Power Plant Technology*, Mc Graw Hill Book Co, New Delhi, 2004.
3. Non - Conventional Energy Sources. Rai

COURSE PLAN (WEEK-WISE):

DEPARTMENT OF ELECTRICAL& ELECTRONICS ENGINEERING								
LESSON PLAN ACADEMIC YEAR 2020-2021 II SEM								
Course Instructor : S.Marlin				**Class**: EEE-III-A/B				
Subject: Non Conventional Energy Resources; WEF :26/03/2021								
Session		**Date**	**Topic**	**Link for PDF**	**Link for PPT**	**Bloom's Taxonomy**	**Teaching Methodology**	**Text Book**
			UNIT-I					
1	1		Over View of Conventional & Renewable Energy Sources	https://drive.google.com/file/d/1d2BYmKAaf2Oa1geuFBBXYKzQ3X3iLJ0D/view?usp=sharing		Understand		
2	1		Need & Development of Renewable Energy Sources,Types of Renewable Energy Systems		https://drive.google.com/file/d/1_F3i8DgmbMq0w_suEV7bkv1qavAEJP7_/view?usp=sharing	Understand	PPT, Digital Pad	***T1,T2 & R1***
3	1		Renewable and Non-Renewable Energy Sources, the solar energy option,	https://drive.google.com/file/d/1XHCg1xaYBpNQU23RvRIFBs4TPOaLAk-2/view?usp=sharing	https://drive.google.com/file/d/1DSP7U-efONKpTEbA9FGkEJIhPDHPKjHj/view?usp=sharing	Understand	PPT, Digital Pad	
4	1		Environmental impact of solar power, physics of the sun, the solar constant			Remember		
5	1		extra-terrestrial and terrestrial solar radiation			Understand		

6	1		solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.	https://drive.google.com/file/d/1XHCg1xaYBpNQU23RvRIFBs4TPOaLAk-2/view?usp=sharing	https://docs.google.com/presentation/d/1DSP7U-efONKpTEbA9FGkEJIhPDHPKjHj/edit#slide=id.p2	Remember	PPT, Digital Pad	
			Students PPT					
7	1		**Topics Beyond Syllabus: Issues In HRES**					
8	1		**Mock Test – I**					
9			**UNIT-II**					
10	2		Flat plate and concentrating collectors	https://drive.google.com/file/d/1r6nHPre1vCFftQhFViBR1DZ1zpVQJl5O/view?usp=sharing	https://drive.google.com/drive/folders/1TZUsqIqGY56KQzrYrcAMfhB_gdiVrgiC	Understand	PPT, Digital Pad	**T1,T2 & R1**
11	2		, classification of concentrating collectors, orientation and thermal analysis,			Remember		
12	2		advanced collectors	https://drive.google.com/file/d/1r6nHPre1vCFftQhFViBR1DZ1zpVQJl5O/view?usp=sharing	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Understand		
13	2		: Need for DEC, Carnot cycle, limitations,		https://drive.google.com/file/d/1cyXo2qcecgO8yxed05kkFDu8QUJfQV4x/view?usp=sharing	Remember	PPT, Digital Pad	
14	2		principles of DEC. Thermoelectric generators, seebeck,	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	https://drive.google.com/file/d/1cyXo2qcecgO8yxed05kkFDu8QUJfQV4x/view?usp=sharing	Understand		
15	2		Flat plate and concentrating collectors		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember		
16	2		peltier and joul			Understand		

			Thomson effects					
17	2		Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember	PPT, Digital Pad	
18	2		classification of concentrating collectors, orientation and thermal analysis, advanced collectors.	https://drive.google.com/drive/folders/1zTLExpZinPryOLzAISpvk5VP3hPxwP1J?usp=sharing	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Understand	PPT, Digital Pad	
19	2		hall effect, magnetic flux, MHD accelerator		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember	PPT, Digital Pad	
20	2		MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects.		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Understand		
21	2		Hybrid Systems, Wind Resource Assessment			Remember		
22	2		Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions					
			Students PPT					
23			**UNIT-III**					

24	3		Different methods of solar storage	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Understand	PPT, Digital Pad	**T1,T2 & R1**
25	3		Sensible, latent heat and stratified storage		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember		
26	3		solar ponds	https://drive.google.com/file/d/1XHCg1xaYBpNQU23RvRIFBs4TPOaLAk-2/view?usp=sharing		Understand		
27	3		Solar Applications-solar heating/cooling technique		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember		
28	3		solar distillation and drying			Understand	PPT, Digital Pad	**T1,T2 & R1**
29	3		photovoltaic energy conversion	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember		
			Students PPT			Understand		
30	3		OTEC, Principles utilization, setting of OTEC plants	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G		Remember		
31	3		thermodynamic cycles.		https://drive.google.com/file/d/1Ci-l8LRSlZ3AKRiXLtJI-xTWEwQpZw2y/view?usp=sharing	Understand		
32	3		Tidal and wave energy: Potential and conversion techniques	https://drive.google.com/file/d/1Ci-l8LRSlZ3AKRiXLtJI-xTWEwQpZw2y/view?usp=sharing		Remember		
33	3		mini-hydel power plants, and their economics..			Understand		
34			**Mock Test – II**			Remember		
35	4		**UNIT-IV**					
36	4		Wind Energy**:** Sources and potentials	https://drive.google.com/file/d/1zOfGMCmGZ9tUBEPcny4uwcNgN5Q9kz-	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Understand	PPT, Digital Pad	**T1,T2 & R1**

37	4		horizontal and vertical axis windmills	6/view?usp=sharing	https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember		
38	4		horizontal and vertical axis windmills			Understand		
			Students PPT					
39			**UNIT-V**					
40	5		Principles of Bio-Conversion, Anaerobic/aerobic digestion	https://drive.google.com/file/d/18Kjm1xr3_oLcjfU3F3GX2ZUTkv2J32lT/view?usp=sharing	https://www.slideshare.net/asertseminar/biogas-ppt	Understand		
41	5		, I.C. Engine operation and economic aspects.		https://drive.google.com/drive/folders/1gUjRcYJEMOZrx7i3vTLZRJPZ5pdAqR6G	Remember	PPT, Digital Pad	**T1,T2 & R1**
42	5		. types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking,	https://drive.google.com/file/d/18Kjm1xr3_oLcjfU3F3GX2ZUTkv2J32lT/view?usp=sharing	https://www.slideshare.net/asertseminar/biogas-ppt	Understand		
43	5		Geothermal Energy**:** Resources, types of wells		https://drive.google.com/file/d/1dM44j0_dZlkHois9empnbOR82ow-fncb/view?usp=sharing	Remember		
44	5		methods of harnessing the energy, potential in India.	https://drive.google.com/file/d/19U8tUrY9FyZW44xrkPV2VVZwBCDKvfro/view?usp=sharing	https://drive.google.com/file/d/1dM44j0_dZlkHois9empnbOR82ow-fncb/view?usp=sharing	Understand		
			Students PPT					
45			University questions Revision					
46			University questions Revision					
47			University questions Revision					
48			**Topics Beyond Syllabus:**					

			Surveys On offshore WECS											
	Program Outcomes									**Program Specifc Outcomes**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	1	2	1	_	_	_	_	_	2	2
CO2	3	2	3	2	2	2	2	_	_	_	_	_	2	1
CO3	2	3	2	2	3	2	3	_	_	_	_	_	1	2
CO4	3	3	3	2	3	2	2	_	_	_	_	_	2	3
CO5	2	2	2	2	2	2	2	_	_	_	_	_	2	2
AVG	2.6	2.4	2.4	1.8	2.2	2.0	2.0	_	_	_	_	_	1.8	2

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

QUESTION BANK (JNTUH):

UNIT I

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	List the various types of non conventional energy sources	Understand	2
2	What are the limitations in RES?	Understand	1
3	Mention the present contribution of different types of plants in India	Knowledge	2
4	What is the approximate amount of total power generation in India?	knowledge	2
5	What are conventional sources of energy?	Knowledge	2

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Write about the availability energy consumption pattern and growth rate in India.	Knowledge	2
2	Explain why it is necessary to develop non-conventional method of generating electrical energy.	Understand	2
3	What are the conventional sources of energy and explain briefly?	Knowledge	1
4	What are the non-conventional sources of energy and explain briefly?	Knowledge	2
5	Discuss the following (a) Obstacle to the implementation of renewable energy sources. (b) Advantages of renewable energy sources.	Knowledge	2

UNIT II

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	List the various types of solar energy collectors	Knowledge	**2**
2	List any four applications of solar collectors	Understand	**2**
3	List any four disadvantages of solar energy	Understand	**2**
4	Draw the block diagram of stand-alone PV system.	Understand	**2**
5	Draw the block diagram of grid connected PV system.	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain in detail about the operation of solar PV system.	Understand	**2**
2	Compare flat plate collector and concentrated collector	Understand	**2**
3	Explain in detail about stand alone PV system.	Knowledge	**2**
4	Explain in detail about grid connected PV system.	Knowledge	**2**
5	Explain principle of Natural and Forced convection	Understand	**2**
6	Explain in detail about anyone of the solar engines.	Understand	**2**

UNIT III
Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	List the various components of wind energy system	Understand	**2**
2	Write down the various types of wind power plants	Understand	**2**
3	What is the principle of wind power generation?	Apply	**3**
4	What are the types of wind mills?	Understand	**2**
5	What are factors consider while selecting wind power generation?	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the principle of wind energy conversion system.	Remember	**3**
2.	Explain all the parameters in wind energy system design.	Apply	**3**
3	Describe about the horizontal axis wind mill	Understand	**2**
4.	Describe about the vertical axis wind mill	Understand	**2**
5.	Explain the working principle of induction generator.	Understand	**2**

UNIT IV
Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What is geothermal power?	Understand	**2**
2	Discuss the disadvantages of geothermal plant.	Understand	**2**
3	Discuss the advantages of geothermal plant.	Apply	**3**
4	What are the constituents of biogas?	Understand	**2**
5	Write any two items used as biomass fuels	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain with neat sketches, the operation of a geothermal power plant.	Understand	**2**
2	a) Write short note on bio energy from agriculture waste. (b) Write short note on bio energy by burning plants.	Understand	**2**
3	(a) Write about energy from biomass. (b) Write about energy from biogas.	Understand	**2**
4	What are the factors affecting biogas generation.	Apply	**3**
5	What is geothermal energy? How can geothermal energy are utilized for electric power Generation?	Understand	**2**

UNIT V

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Differentiate tide and wave	Understand	**2**
2	Mention the type of tidal power turbine.	Apply	**3**
3	What are spring and neap tides?	Apply	**3**
4	What is OTEC energy	Understand	**2**
5	Give the advantages of tidal power plant.	Understand	**2**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain how ocean tides are generated and how the power can be tapped? Discuss the limitations of this method.	Understand	**2**
2	Describe the construction and principle of operation of a turbine used for tidal power.	Understand	**2**
3	Describe the single basin arrangement in tidal power generation.	Apply	**3**
4	Describe the different types of turbines in use for small scale hydroelectric Power Plants.	Apply	**3**
5	What are the main types of OTEC power plants? Describe their working in brief.	Apply	**3**

OBJECTIVE QUESTIONS:

UNIT I

MCQ(s):

Which of the following is a disadvantage of renewable energy?
a) High pollution
b) Available only in few places
c) High running cost
d) Unreliable supply

A Solar cell is an electrical device that converts the energy of light directly into electricity by the _____
a) Photovoltaic effect
b) Chemical effect
c) Atmospheric effect
d) Physical effect

In hydroelectric power, what is necessary for the production of power throughout the year?
a) Dams filled with water
b) High amount of air
c) High intense sunlight
d) Nuclear power

The main composition of biogas is _____
a) Methane
b) Carbon dioxide
c) Nitrogen
d) Hydrogen

Which Ministry is mainly responsible for research and development in renewable energy sources such as wind power, small hydro, biogas and solar power?
a) Human Resource Development
b) Agriculture and Farmers Welfare
c) Ministry of New and Renewable Energy
d) Health and Family Welfare

Fill in the blanks:

_____ power have a large amount of installed grid interactive renewable power capacity in India.

The world's first 100% solar powered airport located at _____

The largest Wind Farm located in India is located at _____.

Is nuclear energy a Renewable Energy? _____.

Wind is beneficial resource of energy as it doesn't cause _____.

UNIT II

MCQ(s):

Which of the following energy has the greatest potential among all the sources of renewable energy?
a) Solar energy
b) Wind Energy
c) Thermal energy
d) Hydro-electrical energy

What is the rate of solar energy reaching the earth surface?
a) 1016W
b) 865W

c) 2854W
d) 1912W

What is total amount of solar energy received by earth and atmosphere?
a) 3.8 X 1024 J/year
b) 9.2 X 1024 J/year
c) 5.4 X 1024 J/year
d) 2.1 X 1024 J/year

In what form is solar energy is radiated from the sun?
a) Ultraviolet Radiation
b) Infrared radiation
c) Electromagnetic waves
d) Transverse waves

Solar radiation received at any point of earth is called _____
a) Insolation
b) Beam Radiation
c) Diffuse Radiation
d) Infrared rays

Fill in the blanks:

The value of Solar Constant is _____

The extraterrestrial radiation flux varies by ____ % over a year**.**

Absorption of Solar radiations at earth's surface occur due to presence of __.

The zenith angle is the angle made by the sun's rays with the ____ to a _____ surface.

Beam radiations are measured with _____.

UNIT III

MCQ(s):

1. How much is the energy available in the winds over the earth surface is estimated to be?
a) 2.9 X 120 MW
b) 1.6 X 107 MW
c) 1 MW
d) 5MW

2. How much wind power does India hold?
a) 20,000 MW
b) 12,000 MW
c) 140,000 MW
d) 5000 MW

3. What is the main source for the formation of wind?
a) Uneven land
b) Sun
c) Vegetation
d) Seasons

4. What type of energy is wind energy?
a) Renewable energy
b) Non-renewable energy
c) Conventional energy
d) Commercial energy

5. What are used to turn wind energy into electrical energy?
a) Turbine
b) Generators

c) Yaw motor
d) Blades

Fill in the blanks:

6. At what range of speed is the electricity from the wind turbine is generated _____?
7. Wind energy is harnessed as _____ energy with the help of windmill or turbine.
8. The installed capacity of wind energy in India is about _____MW.
9. The main source of formation of wind is _____.
10. _____ induction generator is used in wind power plant.

UNIT IV

MCQ(s):

1. The process of producing energy by utilizing heat trapped inside the earth surface is called _____
a) Hydrothermal energy
b) Geo-Thermal energy
c) Solar energy
d) Wave energy

2. What is hot molten rock called?
a) Lava
b) Magma
c) Igneous rocks
d) Volcano

3. How many kinds of Geo thermal steams are there?
a) 2
b) 3
c) 4
d) 5

4. What does EGS stand for in geothermal energy?
a) Engraved Geothermal systems
b) Enhanced geothermal system
c) Exhaust gas system
d) Engineered geo physical system

5. Which of the following forestry materials can be used as biomass?
a) Logging residues
b) Tallow
c) Fish oil
d) Manure

Fill in the blanks:

6. The hole on earth's surface from where the steam from the earth comes out is called as _____.
7. Biomass is useful to produce _____
8. Earth's outer layer rock is called as _____
9. The aerobic digestion of sewage is used to produce _____
10. The bio ethanol is subjected to rectification to remove _____

UNIT V

MCQ(s):

1. How is OTEC caused?
a) By wind energy
b) By geothermal energy
c) By solar energy
d) By gravitational force

2. What does OTEC stand for?
a) Ocean thermal energy cultivation
b) Ocean thermal energy conversion

c) Ocean techno energy conservation
d) Ocean thermal energy consumption

3. Which country has world's largest tidal power plant?
   a) Netherlands
   b) South Korea
   c) Laos
   d) Bolivia
4. For exactly how much time does it take for one tidal cycle?
   a) 22h, 20min
   b) 24h, 50min
   c) 20h, 10min
   d) 22h, 50min
5. Which of the turbine can be mounted vertically and horizontally?
   a) Pelton wheel
   b) Kaplan turbine
   c) Gorlov turbine
   d) Francis turbine

Fill in the blanks:

1. Water to the turbine is allowed through the _____
2. A tide whose difference between high and low tides is least is called as _____
3. _____ tides occur when there is so much interference with continents.
4. _____ turbine is commonly used in tidal energy.
5. The first wave energy project in India is kept at _____.

3. WEBSITES:

1. www.pveducation.org
2. https://mnre.gov.in/
3. https://www.renewableenergyworld.com
4. https://www.iea.org

4. JOURNALS:

1. https://www.journals.elsevier.com/renewable-energy
2. www.mdpi.com/journal/energies
3. https://www.journals.elsevier.com/renewable-and-sustainable-energy-reviews
4. https://www.journals.elsevier.com/renewable-and-sustainable-energy-reviews

5. LIST OF TOPICS FOR STUDENT SEMINARS:

1. A brief about installed capacity of solar power plant in the world.

6. CASE STUDIES/SMALL PROJECTS

1. Real time installation of solar PV based projects.
2. Case study on installed solar tree.