

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MET458	ADVANCED ENERGY ENGINEERING	PEC	2	1	0	3

Preamble: This course provides basic ideas about various energy source and its environmental impacts.

Prerequisite : Nil

Course Outcomes : After completion of the course the student will be able to

CO1	Explain the concept of various types of power generation
CO2	Explain solar and wind power generation and its economics
CO3	Explain biomass energy sources and its economics
CO4	Explain various renewable energy sources
CO5	Explain environmental impacts of various energy generation

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1										
CO 2	3	1										
CO 3	3	1										
CO 4	3	1										
CO 5	3	1				1	1					
CO 6	3	1										

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:**Course Outcome 1 (CO1):**

1. Discuss the renewable energy potential of India.
2. Explain briefly global energy resources.
3. Explain the working and components of a thermal power plant with the help of a neat layout.

Course Outcome 2 (CO2):

1. Explain briefly about the different types of solar collectors with neat sketches.
2. Explain the working of solar photovoltaic cells.
3. List the different methods used to estimate wind speed at a location.
4. Discuss site selection for wind power plants?

Course Outcome 3 (CO3):

1. Which are the main sources of Biomass?
2. With a neat sketch explain the working of a fixed dome type biogas plant.
3. Explain the biochemical and thermo chemical methods of biomass conversion.

Course Outcome 4 (CO4):

1. Explain the working principle of MHD power generation with a sketch.
2. Explain the components and working principle of any one hybrid power plant with sketches.
3. With the help of a neat diagram explain the working principle and applications of fuel cells.

Course Outcome 5 (CO5):

1. Explain any three methods for controlling air pollution by thermal power plants.
2. What is cause for the loss of biodiversity and how is biodiversity protected?
3. Describe the actions to be taken for sustainability of energy.

Model Question Paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
VI SEMESTER B.TECH DEGREE EXAMINATION
MET458: ADVANCED ENERGY ENGINEERING

Maximum: 100 Marks

Duration: 3 hours

PART A

Answer all questions, each question carries 3 marks

1. Elaborate on the current global energy supply scenario.
2. What are the renewable energy resources? Discuss their importance in India's power requirement contest.
3. Explain the basic principle of wind energy conversion.
4. Distinguish between active and passive solar energy systems.
5. Explain the category of biomass resources.
6. "Energy released from biomass comes from Sun". elaborate on this point
7. Mention the impact of tidal energy power plants in the environment
8. Name the different processes used for Hydrogen production.
9. What is biodiversity?
10. List any four sources of land degradation (10 X 3 = 30 marks)

PART B

Answer one full question from each module

Module 1

11. (i) Sketch the layout of a diesel power plant. Explain the layout. (10 marks)
- (ii) How do Industry Nation and Globe would benefit from energy efficiency programs. (4 marks)

OR

12. Give the schematic layout of a thermal power plant and explain its working with the help of Rankine cycle (14 marks)

Module 2

- 13 Explain briefly about the different types of solar collectors with neat sketches. (14 marks)

OR

14. (i) Elaborate on the construction and working of the different types of horizontal axis wind turbine. (10 marks)
- (ii).What is the advantages of wind energy conversion systems? (4 marks)

Module 3

15. (i) Explain the biochemical and thermo chemical methods of biomass conversion (10 marks)
(ii) What is the difference between biomass and biogas? (4 marks)

OR

16. (i).With a neat sketch explain the working of a fixed dome type biogas plant. (10 marks)
(ii). Write a short note on gasification of biomass? (4 marks)

Module 4

17. With the help of a schematic diagram explain the closed cycle MHD and open cycle MHD (14 marks)

OR

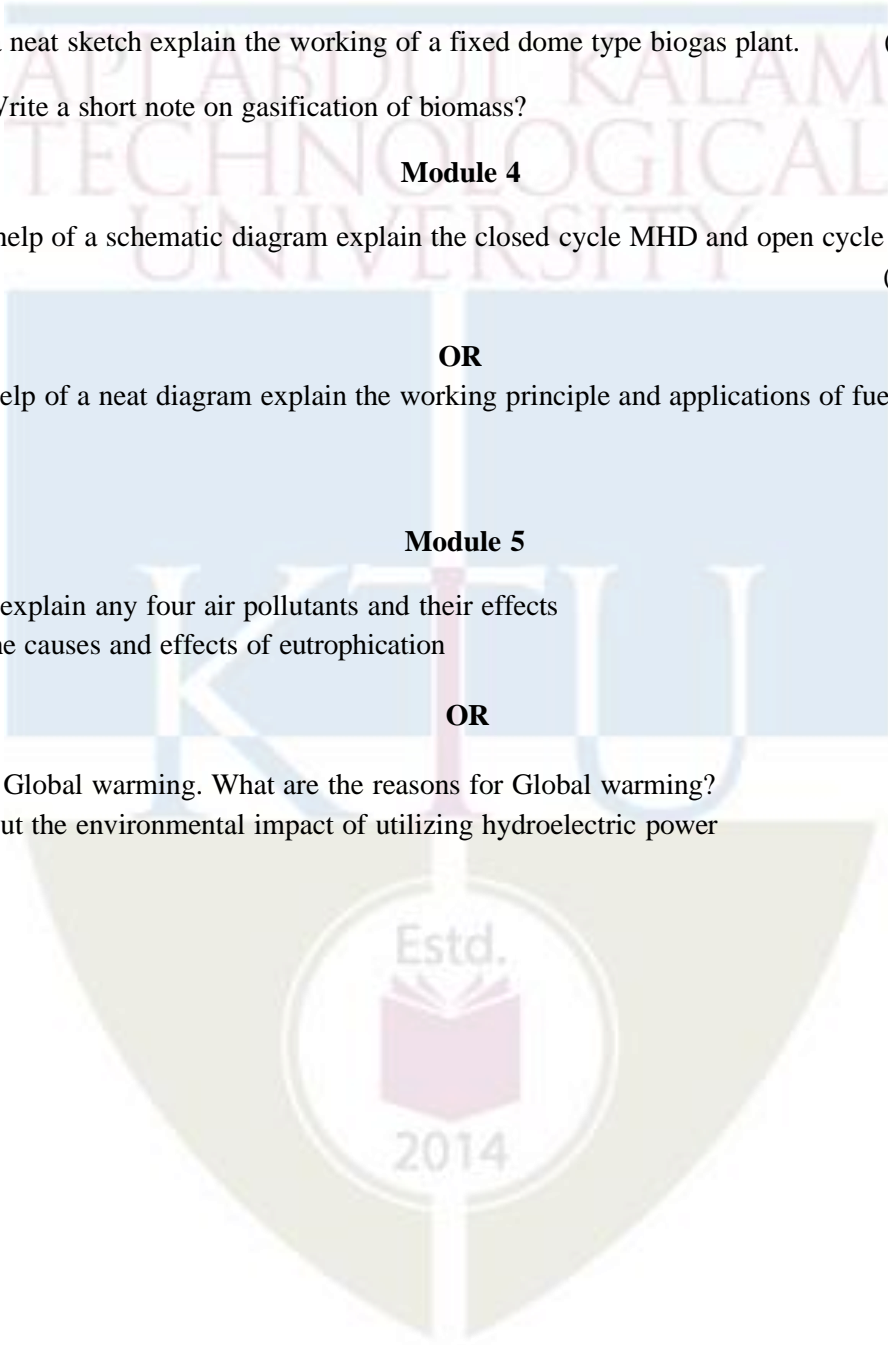
- 18.With the help of a neat diagram explain the working principle and applications of fuel cells. (14 marks)

Module 5

- 19.(i).Briefly explain any four air pollutants and their effects (8 marks)
(ii) Explain the causes and effects of eutrophication (6 marks)

OR

- 20 (i).Define Global warming. What are the reasons for Global warming? (10 marks)
(ii). List out the environmental impact of utilizing hydroelectric power (4 marks)



Syllabus

Module 1

Introduction to the course, Global and Indian energy resources. Energy demand and supply. components, layout and working principles of steam, hydro, nuclear, gas turbine and diesel power plants .

Module 2

Solar Energy- passive and active solar thermal energy, solar collectors, solar thermal electric systems, solar photovoltaic systems, economics of solar power
Wind Energy- Principle of wind energy conversion system, wind turbines, aerodynamics of wind turbines, wind power economics, Introduction to solar-wind hybrid energy

Module 3

Biomass Energy – Biomass as a fuel, thermo-chemical, bio-chemical and agro-chemical conversion of biomass- pyrolysis, gasification, combustion and fermentation, transesterification, economics of biomass power generation, future prospects

Module 4

Other Renewable Energy sources – Brief account of Geothermal, Tidal, Wave, MHD power generation. Fuel cells – general description, types, applications. Hydrogen energy conversion systems, hybrid systems- Economics and technical feasibility

Module 5

Environmental impact of energy conversion – ozone layer depletion, global warming, greenhouse effect, loss of biodiversity, eutrophication, acid rain, air and water pollution, land degradation, thermal pollution, Sustainable energy, promising technologies, development pathways

Text Books:

1. P K Nag, Power Plant Engineering, TMH, 2002
2. Jefferson W Tester, Sustainable Energy Choosing among options, PHI, 2006
3. Tiwari G N, Ghosal M K, Fundamentals of renewable energy sources, Alpha Science International Ltd., 2007

Reference Books:

1. David Merick, Richard Marshall, Energy, Present and Future Options, Vol.I & II, John Wiley & Sons, 2001
2. Godfrey Boyle, Renewable Energy : Power for a Sustainable Future, Oxford University Press, 2012
3. Herbert E. Merritt, Hydraulic control systems, John Wiley & Sons, 2012
4. Roland Wengenmayr, Thomas Buhrke, 'Renewable Energy: Sustainable energy concepts for the future, Wiley – VCH, 2012
5. Twidell J W and Weir A D, Renewable Energy Resources, UK, E&F.N. Spon Ltd., 2006

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
I	Introduction to the course, Global and Indian energy resources. Energy demand and supply. Components, layout and working principles of steam, hydro, nuclear, gas turbine and diesel power plants	7
II	Solar Energy- passive and active solar thermal energy, solar collectors, solar thermal electric systems, solar photovoltaic systems, economics of solar power	6
	Wind Energy-Principle of wind energy conversion system, wind turbines, aerodynamics of wind turbines, wind power economics, Introduction to solar-wind hybrid energy	5
III	Biomass Energy – Biomass as a fuel, thermo-chemical, bio-chemical and agro-chemical conversion of biomass-pyrolysis, gasification, combustion and fermentation, transesterification, economics of biomass power generation, future prospects	6
IV	Other Renewable Energy sources – Brief account of Geothermal, Tidal , Wave, MHD power generation. Fuel cells – general description, types, applications. Hydrogen energy conversion systems, hybrid systems- Economics and technical feasibility	6
V	Environmental impact of energy conversion – ozone layer depletion, global warming, greenhouse effect, loss of biodiversity, eutrophication, acid rain, air and water pollution, land degradation, thermal pollution, Sustainable energy, promising technologies, development pathways`	6