

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: CHEMICAL ENGINEERING (05)

SUBJECT NAME: ENERGY TECHNOLOGY

SUBJECT CODE: 2170505

B.E. 7th SEMESTER

Type of course: Chemical Engineering.

Prerequisite: None.

Rationale: To provide an idea of the challenges in the field of energy management and to provide a perspective on energy technology. Students will learn the systems dimensions of the energy problems and its historical perspective on energy technology and system development. For different types of energy sources utilization in industries, the procedure of power generation, transportation along with conventional and advanced application in different sectors should be known by the student. This subject will guide students in the same direction.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
PA	ALA	ESE		OEP						
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No.	Topic	Teaching Hours	(%) Weightage
1.	An Introduction to Energy Sources: Energy sources (conventional & non-conventional), renewable energy resources, primary & secondary energy sources, energy chain, energy demand, national energy strategy & plan, energy management, energy audit & conservation	02	4
2.	Definitions, Units & Measures Proximate & ultimate analysis, calorific values, rank of coal, coking & caking, gasification, basis for reporting results of analysis, units & conversion factors	03	6
3.	Solid Fuels Wood & charcoal, peat, lignite, sub-bituminous & bituminous coals, semianthracite and anthracite coals, cannel & boghead coal, origin of coal, composition of coal, analysis & properties of coal, problems	03	6

4.	Processing of Solid Fuels Coal preparation, washability curve, dry & wet washing methods of coal, washer efficiency, gasification & liquefaction of solid fuels, problems.	04	7
5.	Solar Energy Solar radiation & related terms, measurement of solar radiation, solar energy collectors – flat plate collector, air collector, collectors with porous absorbers, concentrating collectors, applications & advantages of various collectors, selective absorber coatings, solar energy storage systems (thermal, electrical, chemical & mechanical), solar pond, applications of solar energy.	04	8
6.	Wind Energy Basic principles, power in wind, force on blades & turbines, wind energy conversion, site selection, basic components of wind energy conversion systems (WECS), classification of WECS, wind energy collectors, applications of wind energy	04	7
7.	Energy from Biomass Introduction, energy plantation, biomass conversion technologies, photosynthesis, biogas generation, factors affecting biogas generation, classification of biogas plants & their comparisons, types of biogas plants, biogas from plant wastes, community plants & site selection, digester design considerations, design calculations, methods of maintaining & starting biogas plants, properties & utilisation of biogas, thermal gasification of biomass, pyrolysis, alternative liquid fuels	05	9
8.	Geothermal Energy Geothermal resources, hydrothermal resources, liquid dominated systems, geopressured resources, petrothermal systems, magma resources, energy conservation & comparison with other resources, applications of geothermal energy	05	9
9.	Energy from Oceans Principle, OTEC, methods (open cycle & close cycle) energy from tides, components of tidal power plants, operation, methods of utilization of tidal energy, storage, ocean waves, wave energy conversion devices	04	8
10.	Fuel Cell Introduction, hydrogen – oxygen fuel cell, ion exchange membrane cell, fossil fuel cell, molten carbonate cell, advantages & disadvantages, conversion efficiency, polarisation, type of electrodes, applications of fuel cells	05	9
11.	Hydrogen & Methanol Properties of Hydrogen, production and application of	05	9

	hydrogen, thermochemical methods, fossil fuel methods, solar methods, storage & transportation, safety & management.		
12.	Magneto Hydro-Dynamic (MHD) Power Generation Principle, MHD system, open cycle system, closed cycle system, design problems & developments, advantages, materials for MHD generators, magnetic field & super conductivity	05	9
13.	Nuclear Energy Fission, fusion, fuel for nuclear fission reactor (exploration, mining, milling, concentrating, refining, enrichment, fuel fabrication, fuel use, reprocessing, waste disposal), Nuclear fuel cycle, storage & transportation, uranium enrichment process, nuclear reactor power plant, fast breeder reactor, boiling water reactor, pressurised heavy & light water reactor, Nuclear waste management.	05	9

Reference Books:

1. Fuels & combustion by Samir Sarkar, Orient Longmans(1974)
2. Solar Energy by Sukatame, Tata McGraw Hill, New Delhi
3. Energy Technology by Rao & Parulaker.
4. Energy Sources 2nd Ed. by G. D. Rai, Khanna Publications, New Delhi

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	15	15	5	5	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome: After learning the course the students should be able:

1. To make students aware about all the energy sources available and the ways to turn it into power.
2. To understand the principles behind different non conventional energy sources.
3. To make student understand the global scenario of energy sector and to work on better economical solutions of it.
4. To utilize the renewable energy in problem solving where conventional energy are not fruitful and require replacement.
5. To understand the design and applications of power generating devices using renewable energy sources as per industrial requirement.

List of Tutorials:

Students can select any type of renewable energy and try to find out the application in chemical or other industries and can suggest modification in the energy production techniques, which can make the surrounding of plant environmental friendly and economical at the same time. Each group of students are expected to create a way to utilize renewable energy in innovative way and prepare report of project assigned to his/her group. In addition, each group is expected to give a power point presentation during the semester. The presenter will be selected randomly just prior to the presentation.

List of Open Source Software/learning website:

- Students can refer to video lectures available on various websites including NPTEL.
- Students can refer to the CDs which are available with some reference books for the solutions of problems using softwares. Students can develop their own programs for the solutions using excel, Chemical and other simulation softwares.

ACTIVE LEARNING ASSIGNMENTS:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.