

**B. Tech. III Semester V**

**Subject Name :** Sustainable Energy System

**Subject Code:** BTCL15503

**Type of course :** Open Elective I

**Prerequisite :** Environment Science(BTMD17102)

**Rationale :** Students will be exposed to the status of energy resources, its interaction with environment different renewable energy sources technologies, different techniques and technologies for energy management and energy conservation along with the economic aspects of renewable energy.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

**CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Content:**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<b>Introduction to Sustainability:</b> Need and concept of sustainability, Agenda 21, social environmental and economic sustainability concept, sustainable development, Sustainable Approach to Energy Management	8	18%
2	<b>Basic Concept of Sustainable Habitant:</b> Green building, green material for building construction, material selection for sustainable design, green building certification, methods for increasing energy efficiency of building, sustainable transport	12	27%
3	<b>Energy-source:</b> world energy scenario, India's energy scenario basic concept of energy source, classification of energy sources Need of energy systems and materials	10	20%
4	<b>Energy Conservation:</b> Energy generation from waste bio-chemical conversion, Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion, Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion	15	35%

**OE-I: Open Elective -I**

**Suggested Specification table with Marks (Theory/Practical):**

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	20	15	10	10	20

**Legends: R:** Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **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.

**Reference Text Books:**

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Sustainable Energy system Engineering: The complete Green building Design Resource	Peter Gevorkian	ISBN: 9780071473590 McGraw-Hill Education	2007	1 <sup>st</sup>
2	Sustainable Energy system: From Primary to End use	Dr. Leonel Nunes , Leonel Jorge Ribeiro Nunes.	Mdpi AG 978-3039210961	2019	-
3	Sustainable Energy Technologies	Eduardo Rincón-Mejía and Alejandro de las Heras	CRC press Taylor and Francis Group	2017	1 <sup>st</sup>
4	Principle of Sustainable Energy system	Charles F. Kutscher, Jana B. Milford, Frank Kreith	CRC press ISBN 9781498788922	2018	3 <sup>rd</sup>
5	Renewable Energy: Power for a Sustainable Future	Boyle	Oxford University Press  ISBN 978-0199681273	2012	3 <sup>rd</sup>

**Course Outcome:**

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Learn about the economic, social, and environmental aspects of sustainability and some frameworks for defining and measuring progress toward a sustainable society( <i>R, U... cognitive level</i> )	25
CO-2	Assess the building from energy and resource conservation point of view( <i>U,A,N,E... cognitive level</i> )	20
CO-3	Identify the need of energy conversion and the various methods of energy storage( <i>R,U,A... cognitive level</i> )	25
CO-4	Illustrate the concepts of Direct Energy Conversion systems & their applications. ( <i>A,N,E,C... cognitive level</i> )	20
CO-5	Review the environmental benefits for energy conversion( <i>R, U... cognitive level</i> )	10

**Mapping with POs:**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	-	-	1	-	-	2	2	1	1	1	-	1	1	-	1
CO-2	-	1	-	-	-	-	1	-	-	-	-	-	-	1	-
CO-3	1	1	1	-	2	1	1	-	-	2	1	-	-	1	-
CO-4	1	1	1	1	2	-	-	-	1	2	1	-	1	-	-
CO-5	1	-	1	-	1	1	2	-	-	-	1	1	1	1	-
<b>Rationale*</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>5</b>	<b>4</b>	<b>6</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>

**Rationale\*:** All CO's are compatible and matching to the derived POs to several extents. Students will be exposed to the status of energy resources, its interaction with environment, different renewable energy sources technologies, different techniques and technologies for energy management and energy conservation along with the economic aspects of renewable energy.

**LIST OF PRACTICALS:**

1. To study the various types of gasifier and biogas plant.
2. To study the report of green building
3. To study various material for green building.
4. To study various sources of energy.
5. To study the various techniques for energy conversion.
6. To study green building certificate.