Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electrical and Electronics Engineering
BEE043 SOLAR ENERGY UTILIZATION

Seventh Semester (Odd Semester)

Course (catalog) description

To enable the students to acquire knowledge of solar energy fundamentals and various applications

Compulsory/Elective course: Elective for EEE students

Credit & Contact hours : 3 and 45 hours

Course Coordinator : Mrs.V.Sumathi

Instructors **:** Mrs.V.Sumathi

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mrs.V.Sumathi	Final year EEE	KS 304	04422290125	hod.eee@bharathuniv.ac.in	9.00-9.50 AM

Relationship to other courses:

Pre –requisites **:** BPH201 Enginnering physics-II

Assumed knowledge : To enable the students to acquire knowledge of solar energy fundamentals and various applications

Syllabus Contents

UNIT I SOLAR RADIATION **9**

Sun and earth geometry, solar radiation-beam and diffuse radiations, measurement of solar radiation – pyranometer, pyrheliometer, sunshine recorder. Solar collectors and applications.

UNIT II SOLAR THERMAL SYSTEMS **9**

Flat plate and evacuated tube collectors, domestic hot water and process heat systems, solar cooker, solar dryer, solar desalination and solar pond.

UNIT III SOLAR POWER PLANT **9**

Principles of solar parabolic concentrators-trough and dish types, compound parabolic concentrators, Fresnel lens collectors, central receiver plant, direct steam generation systems, solar furnaces.

UNIT IV SOLAR PHOTOVOLTAICS **9**

Solar photo voltaic theory, mono and polycrystalline silicon technologies, PV modules and integrated systems, implementation and maintenance.

UNIT V SOLAR-CONSCIOUS BUILDINGS **9**

Orientation and design of buildings, passive solar heat- thermal capacity, insulation, solar cooling-refrigeration and air-conditioning, space heating, sensible and latent heat energy storages in buildings.

Text book(s) and/or required materials

T1. Sukhatme.K, Suhas P. Sukhatme, "Solar energy: Principles of thermal collection and storage", Tata McGraw Hill publishing Co. Ltd, 8th edition,2008.

T2. . Soteris A. Kalogiru, "Solar Energy Engineering: Processes and systems", 1st edition, Academic press, 2009.

Reference Books:

R1. . Duffie.J.A, & Beckman.W.A, "Solar Engineering of Thermal Processes", 3rd edition, John Wiley & Sons, Inc., 2006.

Martin A. Green, "Third generation Photovoltaics: Advanced energy conversion", 1st edition, 2005.

R2 Garg.H.P, Prakash.J, "Solar energy fundamentals and applications", Tata McGraw Hill publishing Co. Ltd, 2006.

http://nptel.ac.in/courses/112105051/22

Computer usage: **Nil**

Professional component

General	0%
Basic Sciences	0%
Engineering sciences & Technical arts	0%
Professional subject	0%
Major elective	100%

Broad area : Circuits |Electrical machines | Electronic | **Power system** | Control &instrumentation

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To enable the students to acquire knowledge of solar energy fundamentals and various applications	Correlates to program outcome		
	H	**M**	**L**
1. Analyze Solar radiation data and its measurement	B,c,d,e,j	A,b,c,d,e H,I,j,	-
2. Understand Operation of solar thermal energy systems	-	C,d,e,j	-
3. Understand the working of solar concentrators and their applications to produce energy	-	A,c,d,i	-
4. Understand the photovoltaic theory and implementation process	-	B,c,g,h	-
5. Understand the design of Solar conscious buildings	-	C,e,f,g	-

Sun and earth geometrySun and earth geometry

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**SOLAR RADIATION**		
1.	Sun and earth geometry	NO	(T1)
2.	solar radiation-beam and diffuse radiations	NO	
3.	measurement of solar radiation	NO	
4.	pyranometer	NO	
5.	pyrheliometer	NO	
6.	sunshine recorder	NO	
7.	Solar collectors and applications	NO	
8.	Review of Unit I	NO	
9.	Surprise Test	NO	
UNIT II	**SOLAR THERMAL SYSTEMS**		
10.	Flat plate and evacuated tube collectors	NO	(T2)
11.	domestic hot water	NO	
12.	process heat systems	NO	
13.	solar cooker	NO	
14.	solar dryer	NO	
15.	solar desalination and solar pond	NO	
16.	Quiz	NO	
17.	Review of Unit II	NO	
18.	Surprise Test	NO	
UNIT III	**SOLAR POWER PLANT**		
19.	Principles of solar parabolic concentrators	NO	(R1)
20.	trough and dish types	NO	
21.	compound parabolic concentrators	NO	
22.	Fresnel lens collectors	NO	
23.	central receiver plant	NO	
24.	direct steam generation systems	NO	
25.	solar furnaces	NO	
26.	Quiz	NO	
27.	Review of Unit III	NO	
28.	Surprise Test	NO	
UNIT IV	**SOLAR PHOTOVOLTAICS**		
29.	Solar photo voltaic theory	NO	(R2)
30.	Solar photo voltaic theory	NO	
31.	mono silicon technologies	NO	
32.	polycrystalline silicon technologies	NO	
33.	PV modules	NO	

34.	integrated systems	NO	
35.	integrated systems	NO	
36.	Quiz	NO	
37.	Review of Unit III	NO	
38.	Surprise Test	NO	
UNIT V	**SOLAR-CONSCIOUS BUILDINGS**		
39.	Orientation and design of buildings	NO	(T1)
40.	passive solar heat	NO	
41.	thermal capacity	NO	
42.	insulation	NO	
43.	solar cooling	NO	
44.	refrigeration and air-conditioning	NO	
45.	space heating, sensible and latent heat energy storages in buildings.	NO	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mrs.V.Sumathi **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) An ability to identify, formulate, and solve engineering problems.

c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) An ability to design and conduct experiments, as well as to analyze and interpret data.

e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) An ability to apply reasoning informed by the knowledge of contemporary issues.

g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) An ability to understand professional and ethical responsibility and apply them in engineering practices.

i) An ability to function on multidisciplinary teams.

j) An ability to communicate effectively with the engineering community and with society at large.

k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) An ability to recognize the need for,and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION
Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE
Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM
Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL
Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS
Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
Mrs.V.Sumathi	

Course Coordinator **HOD/EEE**

(Mrs.V.Sumathi) ( )