NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ENERGY AND ENVIRONMENT

COURSE PLAN – PART I			
Name of the programme and specialization	**M. TECH – ENERGY ENGINEERING**		
Course Title	**SOLAR ENERGY UTILIZATION**		
Course Code	**EN605**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	-		
Session	**SEPTEMBER 2021**	**Section (if, applicable)**	-
Name of Faculty	**Dr. M. PREMALATHA**	**Depart- ment**	**ENERGY AND ENVIRONMENT**
Official Email	latha@nitt.edu	**Telepho ne No.**	**+91 9894600407**
Name of Course Coordinator(s) (if, applicable)	-		
Official E-mail	-	**Telephone No.**	-
Course Type (please tick appropriately)	☑ **Core course** ☐ **Electivecourse** ☐ **GIR**		

Syllabus (approved in BoS)

Solar radiation, availability, measurement and estimation; Isotropic and anisotropic models; empirical relations, solar collectors and types: flat plate, concentrating solar collectors, advanced collectors and solar concentrators, Selective coatings Solar water heating, Solar cooking, Solar drying, Solar distillation and solar refrigeration, Active and passive heating and cooling of buildings, Solar Chimney, Solar drying Solar thermal power generation, Home lighting systems, Solar lanterns, Industrial process heat systems, Solar thermal power generation and sterling engine, Solar economics. Photo-voltaic cell – characteristics- cell arrays-power electric circuits for output of solarpanels-choppers-inverters-batteries-charge regulators, Construction concepts. Energy Storage - Sensible, latent heat and thermo-chemical storage-pebble bed etc. materialsfor phase change-Glauber's salt-organic compounds. Solar ponds.

COURSE OBJECTIVES
The objective of the course will focus on the following points 1. To explain the fundamentals of characteristics of solar radiation and various methods & calculation of solar radiation measurement. 2. To introduce the interdisciplinary approach in designing, performance analysis and costanalysis of solar thermal and solar PV systems performance. 3. To provide knowledge to improve the currently available technology of the solar energy systems for making the process sustainable, economical and environmentally safe.

MAPPING OF COs with POs

CourseOutcomes	**Programme Outcomes (PO)** (Enter Numbers only)
Upon completion of ENIR 11, students should be able to	
1. Determine the available radiation intensity on titled surface using basic angles and derived angles	**2,3,5**
2. Calculate the optical efficiency and heat transfer efficiency of thermal (flat plate and concentrating) collectors and design the collector for the given applications.	
3. Design of various solar thermal systems and describing the performance of the same	
4. Design a solar PV system for given electrical load and to calculate energy, economical payback period.	
5. Explain the performance of PV cells as a function of radiation intensity, temperature and materials of construction.	

COURSE PLAN – PART II

COURSE OVERVIEW

This course is designed for the post graduate students of Energy Engineering disciplines and it is intended to familiarize the students with the fundamentals of solar energy conversion, design and analyze the solar thermal and photovoltaic systems for heating and power generation applications respectively. In addition cost and life cycle analysis of solar systems will be discussed.

COURSE TEACHING ANDLEARNINGACTIVITIES (Add morerows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 to 4	Solar radiation, availability, measurement and estimation; Isotropic and anisotropic models; empirical relations, solar collectors and types: flat plate, concentrating solar collectors, advanced collectors and solar concentrators, Selective coatings	MS Team, ppt
2	Week 5 to 7	Solar water heating, Solar cooking, Solar drying, Solar distillation and solar refrigeration, Active and passive heating and cooling of buildings, Solar Chimney, Solar drying	MS Team, ppt
3	Week 8	Class Test 1	Examination
4	Week 9 to 11	Solar thermal power generation, Home lighting systems, Solar lanterns, Industrial process heat systems, Solar thermal power generation and sterling engine, Solar economics.	MS Team, ppt
5	Week 12	Class Test 2	Examination
6	Week 13 to 15	Photo-voltaic cell – characteristics- cell arrays- power electric circuits for output of solarpanels- choppers-inverters-batteries- charge regulators, Construction concepts.	MS Team, ppt
7	Week 16 and 18	Energy Storage - Sensible, latent heat and thermo-chemical storage-pebble bed etc. materialsfor phase change-Glauber's salt-organic compounds. Solar ponds	MS Team, ppt

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Class test 1*	week 8	60 minutes	25
2	Case study	week 9	1 week	20
3	Class test 2*	week 12	60 minutes	25
CPA	Compensation Assessment*	Week 16	60 minutes	25
5	Final Assessment **	Week 18-19	120 minutes	30

***Quiz will be conducted through class marker online tool**
****mandatory; refer to guidelines on page 7**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback about the course will be collected by institute through student's MIS portal

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDANCE (E-mail/phone)
Students can meet the course faculty in Department of Energy and Environment (DEE-MAIN) or contact at latha@nitt.edu.
COMPENSATION ASSESSMENT POLICY
Compensation assessment will be conducted only for students who miss in mid semester examination on valid/genuine reasons of medical or other emergencies.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

Text Books and Reference

1. 'Boyle, G. 2004.' Renewable energy: Power for a sustainable future'. Oxford University press.
2. B H Khan, 'Non Conventional Energy Resources'-The McGraw –Hill Second edition.
3. G. D. Rai, 'Non conventional energy sources', Khanna Publishers, New Delhi, 2006.
4. Gilbert M. Masters, 'Introduction to Environmental Engineering and

Science', 2nd Edition, Prentice Hall, 2003.
5. 'Unleashing the Potential of Renewable Energy in India' –World bank report.
6. Godfrey Boyle, Bob Everett and Janet Ramage.2010.'Energy Systems and Sustainability. Power for a sustainable future'. Oxford University press.

FOR APPROVAL

Course Faculty	CC- Chairperson	HOD