Course Contents

1. Give details of the course, on the following lines:

a. Course Code TEE-823

b. Title: Solar Thermal Power Systems

c. Credit Hours 3

d. Objectives As already mentioned under section 3.

e. Outcomes

2. This course will develop in students the understanding of advance processes of solar thermal power generation. The course will provide in-depth knowledge of solar field sizing, designing of high temperature CSP systems and integration of TES systems. Students will be able to analyze the economic viability of power plants as well as consider the environmental impacts of solar thermal power plants.

f. Contents with suggested contact hours

No.	Topics	Text Book	Contact Hours
1	**Solar Thermal Power Systems** • Global scenario and solar potential in Pakistan • Solar thermal power technologies • Solar thermal power plant layout (Solar field block, Thermal block, Power block)	LS, DB, GKK	4
2	**Solar Radiations** • Direction of Beam Radiation, DNI • Absorptance, emittance, reflectance • Solar tracking • Shading • Optic & Geometric concentration ratios	DB, LS, CN	5

3	**Parabolic-Trough Collector (PTC)** • PTC Concentrator, optical losses • PTC receivers, Thermal losses • Heat Transfer Fluid • Solar field sizing • Compound Parabolic Collectors (CPC) • Case Study: PTC plant designing	CN, LS, DB	8
4	**Central Receiver Tower Systems** • Heliostats (Reflectivity, Tracking mode, Optical losses) • Tower receivers w.r.t phase • Tower receiver designs	CN, LS, DB	8
5	**Linear Fresnel Reflectors (LFR)** • Fresnel reflectors • LFR receivers, Thermal efficiency and heat losses • Optical designing of reflectors	CN, LS, DB	4
6	**Parabolic Dish System** • Parabolic dish concentrator • Dish tracking • Thermodynamics of dish Sterling engines	CN, LS, DB	3
7	**Thermal Energy Storage (TES) system** • Sensible, Latent and Thermochemical heat storage • Designing of TES systems • TES integration in CSP power plant	DB, LS	4
8	**Thermal Power Block** • Rankine cycle • Organic Rankine Cycle (ORC) • Steam turbine	SD, EW	3

9	**Economics and Environmental Assessments of Solar Thermal Power Systems** • Feasibility and Economic analysis • Environmental impacts • General risks/hazards in solar thermal power systems	DB, LS, SK	6
	Total		**45**

g. Details of lab work, workshops practice (if applicable). No practical lab work is required; however, software such as RET Screen/SAM, ASAP and T*SOL will be required for designing of CSP systems and economical assessment.

h. Recommended Reading (including Textbooks and Reference books).

S. No.	Title	Author(s)	Assigned Code	Remarks
1	Concentrating Solar Power Technology: Principles, developments and applications	Keith Lovegrove and Wes Stein	LS	Text
2	Solar Engineering of Thermal Processes,	J. A. Duffie, and W. A. Beckman	DB	Reference
3	Concentrated Solar Thermal Energy	Christopher Newton	CN	Reference
4	Principles of Solar Engineering	Y. Goswami, F. Kreith and J. F. Kreider	GKK	Reference
5	Solar Energy Engineering: Processes and Systems	Soteris A. Kalogirou.	SK	Reference
6	Thermal Power Plant Performance	De Souza, Gilberto Francisco Martha	SD	Reference

	Analysis			
7	Steam Plant Operation	Everett Woodruff, Herbert Lammers	EW	Referenc e