Declaration

I hereby declare that the work presented in this Thesis titled ***HELIOSTAT FIELD DESIGN AND RECEIVER PROFILE ESTIMATION USING OPTICAL RAY TRACING TECHNIQUES,*** submitted to the Indian Institute of Technology Jodhpur in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy, is a bonafide record of the research work carried out under the supervision of Dr. V. Narayanan, Department of Physics. The contents of this thesis in full or in parts, have not been submitted to, and will not be submitted by me to, any other Institute or University in India or abroad for the award of any degree or diploma.

Sanjoy Chatterjee 27/07/20

P14PH002

Certificate

This is to certify that the thesis titled ***HELIOSTAT FIELD DESIGN AND RECEIVER PROFILE ESTIMATION USING OPTICAL RAY TRACINGTECHNIQUES***, submitted by Sanjoy Chatterjee(P14PH002) to the Indian Institute of Technology Jodhpur for the award of the degree of ***Doctor of Philosophy***, is a bonafide record of the research work done by him under my supervision. To the best of my knowledge, the contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Dr.V.Narayanan

Ph.D. Thesis Supervisor

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Sanjoy Chatterjee

Ph.D. Student

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List of Symbols

Symbol	*Description*
δ	Déclination angle
ω_1	Hour angle
ψ_1	Latitude
ψ_2	Longitude
θ_1	Elevation /Altitude angle
θ_2	Zenith angle
Φ	Azimuth angle
θ_3	Half angle spread of radiation
ω_2	Angular frequency
ζ	Circum Solar Ratio
θ_4	Radial displacement of radiation
ζ_1	Sunshape model independent of geographic
θ_5	ideal exergy efficiency
σ	Stefan Boltzmann law constant
θ_6	Angle for law of Cosine
D.M	Characteristic diameter for cornfield design
φ_1	Golden angle for spiral setup
θ_a	Acceptance Angle
S_E	Solar Constant

List of abbreviations

Symbol	*Description*
DNI	Daily Normal Irradiance
RS	Radial Staggered
ET	Equation of time
TS	Solar Time
CSR	Circumsolar Ratio
CSP	Concentration Solar Power
HTF	Heat Transfer Fluid
IP	Inclined Plane
SR	Secondary Reflector
AE	Azimuth Elevation
SE	Spinning Elevation
NIO	Non Imaging Optics
TMY	Typical MeteorologicalYear
MCRT	Monte Carlo Ray Tracing
CPC	Compound Parabolic Concentrator
SS	SunShape
RAD	Radial Angular Distribution