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Appendix-A
Nomenclature

Various acronyms and symbols have been used to express the word or group of word in this thesis are followed as,

SS	Solar still
CSS	Conventional Solar still
PSS	Prism type Solar Still
FRP	Fiber Reinforcement plastics
PCM	Phase change material
QD	Quantum dot material
TC	Total cost (INR)
SV	Salvage value (INR)
SFF	Sinking Fund Factor (INR)
ASV	Annual Salvage Value (INR)
MRF	Money recovery factor
AFC	Annual first cost (INR)
AMC	Annual maintenance cost (INR)
ATC	Annual total cost (INR)
AAP	Average annual production (l)
AEE	Annual equivalent energy (kWh)
OAG	Overall annual gain (INR)
A	Surface Area (m^2)
Ex	Exergy
T	Temperature (K)

C Conventional related variable

P Prism shaped variable

Φ Heat of vaporization of water (J/kg)

η Efficiency

ΔT Temperature difference

ΔT_{wg} Temperature difference between basin water and inner glass

$\dot{m}$ Rate of distilled water production (kg/hr.)

m_w mass of water (kg)

n Working life (years)

dT_w change in temperature of water

m_{pcm} mass of PCM (kg)

c_{pcm} specific heat capacity (kJ/kg.K)

dT_{pcm} change in temperature of PCM

L Latent heat capacity of PCM (kJ/kg)

I_{avg} Average solar flux (W/m^2)

T_{span} Period of experiment

Subscript

a Ambient

w Basin water

s Sun

b Basin

in Solar still in

out Solar still out

- For ***Mathematical modelling*** following symbols and subscript were used.

C	Specific heat capacity (kJ/kg.K)
T	Temperature (K)
t	Time (s)
m	mass (kg)
α	Absorptivity
μ	Dynamic viscosity (Pa.s)
A	Area (m2)
Q	Heat Transfer (W)
I	Intensity
h	Heat transfer coefficient (W/m2K)
P	Pressure (Pa)
Nu	Nusselt No.
Gr	Grashof No.
Pr	Prandtl No.
Ra	Rayleigh No.

Subscript

w	Water
g	Glass
bs	Basin
con	Convection heat Transfer
rad	radiation Heat Transfer
evap	Evaporative heat transfer
cd	Conduction heat transfer

sky	Sky
amb	Ambient
w-g	water to glass
g-sky	glass to sky
g-amb	glass to ambient
bs-w	basin to water
bs-in	basin to insulation
bs-amb	Basin to ambient
bs-in	Basin to insulation

Appendix-B
Numerical Data

B.1 Numerical data related to Tilt angle

Table B- 1 On day-1 (Oct. 28, 2019) for Model-1

S.no.	Time	Intensity-1 (W/m²)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output-1 (mL/m²)	Cumulative-1 (mL/m²)
1	10:30	872	42.8	30	30	28.3	0	0
2	11:30	1020	43.1	37	32	30.6	35	35
3	12:30	841	47.7	42	33	33.6	100	135
4	13:30	741	44.2	41	32	34.5	230	365
5	14:30	413	41.8	37	33	34.2	170	535
6	15:30	143	36.6	33	35	32.2	100	635
7	16:30	109	31.1	27	32	30.5	65	700
8	17:30	9	28.7	26	30	29.8	22	722
							Nocturnal Yield	**405**

Table B- 2 On day-1 for Model-2

S.no.	Time	Intensity-2 (W/m²)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output-2 (mL/m²)	Cumulative-2 (mL/m²)
1	10:30	975	40.2	28	27	28.3	0	**0**
2	11:30	1132	42.8	33	34	30.6	45	**45**
3	12:30	927	52.8	40	34	33.6	70	**115**

4	13:30	786	57.1	43	22	34.5	170	**285**
5	14:30	431	56.6	40	22	34.2	185	**470**
6	15:30	169	48.1	37	26	32.2	150	**620**
7	16:30	105	43.2	34	26	30.5	135	**755**
8	17:30	7	36	31	24	29.8	50	**805**
							Nocturnal Yield	**715**

Table B- 3 On day-1 for Model-3

S.no.	**Time**	**Intensity-3 (W/m^2)**	**Water Temperature (°C)**	**Inner glass temperature (°C)**	**Outer glass temperature (°C)**	**Ambient Temperature (°C)**	**Output-3 (mL/m^2)**	**Cumulative-3 (mL/m^2)**
1	10:30	802	34	25	23	28.3	0	0
2	11:30	998	40.6	26	26	30.6	30	30
3	12:30	687	43.2	27	28	33.6	30	60
4	13:30	546	48.3	27	27	34.5	50	110
5	14:30	284	49.3	27	28	34.2	70	180
6	15:30	101	49.2	28	29	32.2	60	240
7	16:30	66	47.7	26	27	30.5	60	300
8	17:30	8	45.1	26	26	29.8	20	320
							Nocturnal Yield	**240**

Table B- 4 On day-2 (Oct. 29, 2019) for Model-1

S.no.	Time	Intensity-1 (W/m²)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output-1 (mL/m²)	Cumulative-1 (mL/m²)
1	10:30	740	43.3	34	29	27.7	0	0
2	11:30	918	46.7	36	30	31	50	50
3	12:30	862	42.4	40	32	33.7	160	210
4	13:30	390	41.7	40	30	34.8	150	360
5	14:30	187	38.6	37	33	35.5	150	510
6	15:30	103	34.2	32	32	33.1	130	640
7	16:30	126	33.8	30	32	31.5	70	710
8	17:30	9	28.2	26	30	29.2	50	760
							Nocturnal Yield	**435**

Table B- 5 On day-2 for Model-2

S.no.	Time	Intensity-2 (W/m²)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output-2 (mL/m²)	Cumulative-2
1	10:30	840	36.7	30	33	27.7	0	0
2	11:30	1027	43.6	35	35	31	12	12
3	12:30	940	51.3	41	40	33.7	60	72
4	13:30	395	55.5	48	23	34.8	100	172
5	14:30	201	56.1	50	22	35.5	150	322

6	15:30	105	53.2	46	24	33.1	180	502
7	16:30	132	50.1	43	24	31.5	150	652
8	17:30	8	46.5	38	24	29.2	140	792
							Nocturnal Yield	**695**

Table B- 6 On day-2 for Model-3

S.no.	**Time**	**Intensity-3 (W/m²)**	**Water Temperature (°C)**	**Inner glass temperature (°C)**	**Outer glass temperature (°C)**	**Ambient Temperature (°C)**	**Output-3 (mL/m²)**	**Cumulative-3 (mL/m²)**
1	10:30	762	31.8	29	24	27.7	0	0
2	11:30	827	36.6	31	26	31	5	5
3	12:30	700	42.5	34	26	33.7	18	23
4	13:30	368	46.5	35	29	34.8	23	46
5	14:30	143	48.8	36	29	35.5	50	96
6	15:30	81	48.3	31	28	33.1	70	166
7	16:30	90	46.9	30	27	31.5	60	226
8	17:30	8	44.7	29	25	29.2	60	286
							Nocturnal Yield	**255**

Table B- 7 On day-3 (Nov. 29, 2019) for Model-1

S.no.	Time	Intensity-1 (W/m^2)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temp (°C)	Output -1 (mL/m^2)	Cumulative -1 (mL)
1	10:00	706	37.5	33	26	28.7	0	0
2	11:00	852	44.9	36	28	32.4	105	105
3	12:00	755	47.2	38	29	32.6	140	245
4	13:00	725	47.7	40	29	33.1	150	395
5	14:00	533	45.5	37	31	31.5	120	515
6	15:00	350	42.3	33	31	31.4	100	615
7	16:00	122	37.8	32	30	30.3	80	695
8	17:00	60	30.9	22	29	26.9	60	755
							Nocturnal Yield	**425**

Table B- 8 On day-3 for Model-2

S.no.	Time	Intensity-2 (W/m^2)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output -2 (mL/m 2)	Cumulative-2 (mL)
1	10:30	783	37.2	31	18	28.7	0	0
2	11:30	950	46.7	38	19	32.4	70	70
3	12:30	837	52.9	40	21	32.6	125	195
4	13:30	783	54.9	43	21	33.1	140	335
5	14:30	604	55.3	46	22	31.5	180	515
6	15:30	377	52.9	42	23	31.4	190	705

7	16:30	122	49.5	39	24	30.3	130	835
8	17:30	56	43.1	37	24	26.9	90	925
							Nocturnal Yield	**735**

Table B- 9 On day-3 for Model-3

S.no.	Time	Intensity-3 (W/m^2)	Water Temperature (°C)	Inner glass temperature (°C)	Outer glass temperature (°C)	Ambient Temperature (°C)	Output-3 (mL/m2)	Cumulative-3 (mL)
1	10:30	662	30.9	22	24	28.7	0	0
2	11:30	746	37.8	23	27	32.4	9	9
3	12:30	628	43.7	23	28	32.6	27	36
4	13:30	564	46.3	23	29	33.1	30	66
5	14:30	384	48	28	28	31.5	40	106
6	15:30	237	47.7	32	29	31.4	50	156
7	16:30	104	46	31	27	30.3	60	216
8	17:30	60	42.1	28	25	26.9	50	266
							Nocturnal Yield	**274**

B.2 Numerical data related to concentration of QD

Table B- 10 Experimental data with 0 g QD

S.N.	Time	Basin water temperature (°C)	Inner glass temperature (°C)	Ambient Temperature (°C)	Yield (mL/m^2)	Cumulative yield (mL/m^2)	Solar radiation (W/m^2)

1	9:30	43	38	33.3	0	0	711
2	10:30	44	40	34.5	85	85	690
3	11:30	46	42	35.8	135	220	893
4	12:30	48	45	36.8	180	400	856
5	13:30	51	46	37.6	230	630	300
6	14:30	47	45.5	37.2	170	800	492
7	15:30	42	39	35.2	90	890	285
8	16:30	38	35.8	33.1	56	946	95
9	17:30	35	31.4	31.2	45	991	13

Table B- 11 Theoretical data with 0 g QD

S.N.	**Time**	**Basin water temperature (ºC)**	**Inner glass temperature (ºC)**	**Ambient Temperature (ºC)**	**Yield (mL/m²)**	**Cumulative yield (mL/m²)**	**Solar radiation (W/m²)**
1	9:30	43.6	38	33.3	0	0	711
2	10:30	46.5	39.43	34.5	104.8	104.79	690
3	11:30	49.12	41.98	35.8	179.1	283.92	893
4	12:30	52.03	43.78	36.8	171.4	455.28	856
5	13:30	47.66	42.6	37.6	237.4	692.68	300
6	14:30	45.29	41.31	37.2	132.7	825.42	492
7	15:30	45.32	39.16	35.2	60.21	885.63	285
8	16:30	39.2	35.49	33.1	97.6	983.23	95
9	17:30	34.3	32.33	31.2	69.08	1052.31	13

Table B- 12 Experimental data with 5 g QD

S.N.	Time	Basin water temperature (ºC)	Inner glass temperature (ºC)	Ambient Temperature (ºC)	Yield (mL/m²)	Cumulative yield (mL/m²)	Solar radiation (W/m²)
1	9:30	43	38	33.3	0	0	711
2	10:30	46	39	34.5	92	92	690
3	11:30	49	41	35.8	195	287	893
4	12:30	54	44	36.8	225	512	856
5	13:30	51	41	37.6	260	772	300
6	14:30	48	40	37.2	170	942	492
7	15:30	46	38	35.2	140	1082	285
8	16:30	42	37	33.1	110	1192	95
9	17:30	38	34	31.2	90	1282	13

Table B- 13 Theoretical data with 5 g QD

S.N.	Time	Basin water temperature (ºC)	Inner glass temperature (ºC)	Ambient Temperature (ºC)	Yield (mL/m²)	Cumulative yield (mL/m²)	Solar radiation (W/m²)
1	9:30	43	38	33.3	0	0	711
2	10:30	48	40.48	34.5	104.79	104.79	690
3	11:30	51	42.86	35.8	195.85	300.64	893
4	12:30	54	44.94	36.8	233.05	533.69	856
5	13:30	49	42.9	37.6	303.5	837.19	300
6	14:30	46	41.56	37.2	131.38	968.57	492
7	15:30	47	40.7	35.2	142.6	1111.17	285

8	16:30	43	36.17	33.1	150.31	1261.48	95
9	17:30	34	32.68	31.2	66.53	1328.01	13

Table B- 14 Experimental data with 10 g QD

S.N.	**Time**	**Basin water temperature (ºC)**	**Inner glass temperature (ºC)**	**Ambient Temperature (ºC)**	**Yield (mL/m²)**	**Cumulative yield (mL/m²)**	**Solar intensity (W/m²)**
1	9:30	44	39	34.2	0	0	645
2	10:30	48	42	35.1	210	210	725
3	11:30	52	44	35.7	320	530	831
4	12:30	58	49	38	370	900	879
5	13:30	60	50	39.4	310	1210	580
6	14:30	53	46	37	260	1470	410
7	15:30	48	42	35.5	240	1710	216
8	16:30	43	40	34.2	180	1890	80
9	17:30	41	38	32.8	120	2010	10

Table B- 15 Theoretical data with 10 g QD

S.N.	**Time**	**Basin water temperature**	**Inner glass temperature**	**Ambient Temperatur**	**Yield**	**Cumulative yield**	**Solar inten**
1	9:30	44	39	34.2	0	0	645
2	10:30	49	43.4	35.1	230.56	230.56	725
3	11:30	54	46.8	35.7	340.6	571.16	831
4	12:30	60	48.9	38	380.46	951.62	879

5	13:30	58.8	51.6	39.4	320.8	1272.42	580
6	14:30	54.2	45.7	37	280.72	1553.14	410
7	15:30	44	41.8	35.5	250.91	1804.05	216
8	16:30	41	38.5	34.2	209.81	2013.86	80
9	17:30	40	36.7	32.8	122.6	2136.46	10

Table B- 16 Experimental data with 15 g QD

S.N.	Time	Basin water temperature	Inner glass temperature	Ambient Temperatur	Yield	Cumulative yield	Solar inten
1	9:30	47	41	34.2	0	0	645
2	10:30	50	45	35.1	370	370	725
3	11:30	56	48	35.7	410	780	831
4	12:30	64	51	38	460	1240	879
5	13:30	65	54	39.4	390	1630	580
6	14:30	59	52	37	350	1980	410
7	15:30	54	49	35.5	310	2290	216
8	16:30	46	42	34.2	260	2550	80
9	17:30	44	40	32.8	160	2710	10

Table B- 17 Theoretical data with 10 g QD

S.N.	Time	Basin water temperature	Inner glass temperature	Ambient Temperatur	Yield	Cumulative yield	Solar inten
1	9:30	47	41	34.2	0	0	645

2	10:30	52.9	44.2	35.1	365	365	725
3	11:30	54.87	48.7	35.7	442.8	807.8	831
4	12:30	61.56	52.8	38	481	1288.8	879
5	13:30	62.26	56.1	39.4	420.4	1709.2	580
6	14:30	58.5	53.8	37	368	2077.2	410
7	15:30	56.6	50.4	35.5	354.7	2431.9	216
8	16:30	51.57	46.1	34.2	271.5	2703.4	80
9	17:30	43.25	42.1	32.8	214.2	2917.6	10

B.3 Numerical data related to modified Solar still

Table B- 18 Experimental data for CSS without PCM and QD

S.N.	Time	Intensity (W/m^2)	Water Temperature (°C)	Inner glass Temperature (°C)	Outer Glass Temperature (°C)	Ambient Temperature (°C)	Output (mL/m^2)	Cumulative (mL/m^2)
1	9:00	610	38	33	33	32.1	0	0
2	10:00	780	40	36	35	33.7	160	160
3	11:00	970	42	38	37	34.6	140	300
4	12:00	1010	43	39	37	37.4	190	490
5	13:00	925	48	41	40	38.1	270	760
6	14:00	817	53	38	39	36.4	310	1070
7	15:00	620	45	36	36	34	260	1330
8	16:00	305	37	36	37	33.6	180	1510
9	17:00	80	35	32	32	31.5	100	1610

10	18:00	14	32	31	30	30.3	40	1650
11	19:00	0	30	30	30	29	10	1660
12	20:00	0	28	28	28	28.9	0	1660
13	21:00	0	25	28	28	28	0	1660
14	22:00	0	25	28	28	27.8	0	1660

Table B- 19 Experimental data for PSS without PCM and QD

S.N.	Time	Avg. Intensity (W/m^2)	Water Temperature (°C)	Avg. Inner glass Temperature (°C)	Avg. Outer Glass Temperature (°C)	Ambient Temperature (°C)	Output (mL/m^2)	Cumulative (mL/m^2)
1	9:00	510	34	33	24	32.1	0	0
2	10:00	630	35	35	25	33.7	150	70
3	11:00	784	41	37	27	34.6	210	200
4	12:00	810	43	40	29	37.4	280	640
5	13:00	800	49	42	30	38.1	220	860
6	14:00	738	55	46	32	36.4	200	1060
7	15:00	524	48	37	34	34	180	1240
8	16:00	276	40	35	35	33.6	160	1240
9	17:00	116	35	32	33	31.5	140	1540
10	18:00	3	33	32	30	30.3	110	1650
11	19:00	0	30	30	29	29	70	1720
12	20:00	0	30	29	26	28.9	50	1770
13	21:00	0	28	29	23	28	40	1810

14	22:00	0	28	29	20	27.8	20	1830

Table B- 20 Experimental data for CSS with PCM only

S.N.	Time	Intensity (W/m2)	C-Water Temperature (°C)	Inner glass Temperature (°C)	Outer Glass Temperature (°C)	Ambient Temperature (°C)	Output (mL)	Cumulative (mL)
1	9:00	623	34	31	27	33.2	0	0
2	10:00	765	36	32	26	32.4	110	110
3	11:00	900	35	32	28	35.4	150	260
4	12:00	981	40	34	28	37.5	240	500
5	13:00	862	44	37	32	37.1	310	810
6	14:00	785	47	39	33	36.4	330	1140
7	15:00	633	43	40	34	33.5	310	1450
8	16:00	332	40	35	31	33.1	240	1690
9	17:00	111	37	33	27	30	190	1880
10	18:00	17	35	31	26	29.1	150	2030
11	19:00	0	30	30	26	28	120	2150
12	20:00	0	32	28	25	28.5	100	2250
13	21:00	0	31	26	24	27	70	2320
14	22:00	0	30	25	24	27	40	2360

Table B- 21 Experimental data for PSS with PCM only

SN	Time	Avg. Intensit	P-Water Temper	Inner glass Temper	Outer Glass Temper	Ambient Temper	Output (mL)	Cumulative (mL)

		y (W/m2)	ature (°C)	ature (°C)	ature (°C)	ature (°C)		
1	9:00	486	33	30	23	33.2	0	0
2	10:00	565	37	32	24	32.4	90	90
3	11:00	717	42	33	26	35.4	110	200
4	12:00	795	45	34	29	37.5	180	380
5	13:00	767	48	36	31	37.1	270	650
6	14:00	713	47	39	34	36.4	300	950
7	15:00	587	43	35	35	33.5	330	1280
8	16:00	310	39	34	36	33.1	310	1590
9	17:00	110	38	32	32	30	280	1870
10	18:00	5	37	30	30	29.1	210	2080
11	19:00	0	34	30	30	28	160	2240
12	20:00	0	34	29	27	28.5	130	2370
13	21:00	0	33	29	26	27	90	2460
14	22:00	0	31	28	25	27	70	2530

Table B- 22 Experimental data for CSS with PCM and QD

	Time	Intensity (W/m2)	C-Water Temperature	C-Inner glass Temperature (°C)	Outer Glass Temperature (°C)	Ambient Temperature (°C)	Output (mL)	C-Cumulative (mL)
1	9:00	589	33	32	28	34.1	0	0
2	10:00	670	37	34	27	31.8	90	90
3	11:00	810	42	37	26	34.4	180	270

4	12:00	900	46	40	29	35	240	510
5	13:00	973	50	41	31	36.4	280	790
6	14:00	841	53	43	33	37	360	1150
7	15:00	672	51	40	33	36.4	400	1550
8	16:00	325	49	39	30	35	380	1930
9	17:00	121	44	37	28	34.4	270	2200
10	18:00	18	38	35	26	32	240	2440
11	19:00	0	35	34	25	31.8	180	2620
12	20:00	0	35	31	24	30	160	2780
13	21:00	0	34	30	23	30.4	140	2920
14	22:00	0	32	30	23	30.1	120	3040

Table B- 23 Experimental data for PSS with PCM and QD

S.N.	**Time**	**Intensity (W/m^2)**	**P-Water Temperature**	**Inner glass Temperature (°C)**	**Outer Glass Temperature (°C)**	**Ambient Temperature (°C)**	**Output (mL/m^2)**	**P-Cumulative (mL/m^2)**
1	9:00	443	35	31	26	34.1	0	0
2	10:00	535	39	36	28	31.8	210	210
3	11:00	695	45	39	29	34.4	320	530
4	12:00	789	52	41	31	35	380	910
5	13:00	790	59	45	32	36.4	430	1340
6	14:00	687	56	43	35	37	390	1730
7	15:00	568	48	40	36	36.4	345	2075
8	16:00	345	44	38	35	35	330	2405

9	17:00	46	39	35	32	34.4	290	2695
10	18:00	4	39	36	33	32	270	2965
11	19:00	0	38	33	30	31.8	240	3205
12	20:00	0	37	32	29	30	200	3405
13	21:00	0	37	31	27	30.4	150	3555
14	22:00	0	37	31	26	30.1	130	3685

B.4 Monthly Solar radiation and Wind velocity Data

Table B- 24 Global solar radiation and wind velocity data throughout year

		Global solar radiation (kWh/m^2-day)		
S. N.	**Month**	**Horizontal Surface**	**Inclined Surface (25^o)**	**Wind velocity (m/s)**
1.	Jan	4.05	4.43	3
2.	Feb	5.32	6.72	3.2
3.	Mar	7.17	7.46	3.9
4.	Apr	7.45	8.42	3.9
5.	May	7.34	8.13	3.7
6.	Jun	6.59	6.80	4.2
7.	Jul	6.14	6.21	4.3
8.	Aug	5.24	5.45	3.5
9.	Sep	4.81	5.69	3.3
10.	Oct	4.61	5.13	2.4

11.	Nov	4.14	4.87	2.3
12.	Dec	3.57	4.22	2.5

B.5 Monthly Ambient temperature (°C)

Table B- 25 Ambient temperature variation from 8 o'clock to 17 o'clock throughout year

hr./ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8	13.4	15	21.1	28.1	31	32.3	31.2	29.3	28.4	24.9	19.7	14.7
9	14.5	18.5	22.4	31.6	32.4	33.4	31.9	30.5	29	26.9	21.4	15.4
10	17.1	21.2	26.7	34.1	35.7	35	32.4	31.6	29.8	30.4	23.8	18.9
11	20	23.1	28.6	35.4	37.5	35.4	33.1	30.9	32.7	31.8	25.4	21.4
12	20.5	23.9	30.1	36.7	36.4	35.9	33.4	30.1	31.4	29.7	27.5	23.7
13	21.2	24.5	33.2	37.1	38.1	37.3	35.6	32.8	32.6	31.4	27.9	24.9
14	21.8	25.3	32.1	37.8	41	38.1	34.7	33.4	33.4	32.7	28.4	24.3
15	20.3	24.4	31	36.6	40.2	34	33.5	28.1	29.1	28.4	24.5	21.6
16	19.6	22.5	30	36	38	35	33	31.4	29.8	30.2	25.1	19.5
17	19.2	21.2	29.4	35.4	37.5	36.7	32.1	32.6	30.5	29.1	24.1	18.1
Average Temp.	**18.76**	**21.96**	**28.46**	**34.88**	**36.78**	**35.31**	**33.09**	**31.07**	**30.67**	**29.55**	**24.78**	**20.25**

Appendix-C
MATLAB program

Theoretical modeling is done with the help of MATLAB's high-level programming language. The MathWorks company created the proprietary multi-paradigm programming language and computing environment known as MATLAB. This MATLAB code can be directly pasted into the MATLAB Editor to obtain the results.

MATLAB Program

```
%% To find the yield of solar still MATLAB program

tw=input('enter the initial water temperature');

tg=input('enter the initial glass temperature');

tamb=input('enter the initial ambient temperature');

tsky=0.0052*(tamb^1.5);

tb=input('enter the initial basin temperature');

%% Here we basically when we do the setup we take the initial temperature reading of the water(tw), inner glass(tg), Ambient(tamb), Basin(tb)


Pw= exp(25.317-(5144/tw));

Pg= exp(25.317-(5144/tg));

%%As we know pressure play very vital role in evaporation of water, here Pw indicates partial pressure of water, Pg indicates partial pressure of glass.


ew=0.9;                    %%epsilon of water

eg=0.9;                    %%epsilon of glass;

tau=0.85;                  %%transmissivity of glass
```

```
Eeff=(1/ew)+(1/eg)-1;    %% effective emmisivity

a1=1; %% As we know surface area play a major role in increasing evaporation (a1= area of basin is meter2)

n=9; %% here n represent the number of times loop work (For number of hour solar still under observation, here solar still observation start from 9:00 AM and observation takes place up to 6:00 PM so we take n=9)

sigma=5.67*(10^(-8));  %% Boltzmann constant

M=input('mass of water in basin'); %% (volume of water= base area× height of water level)

%% here basically water level height is 2 cm so mass is1× 1000×2/100)

g=10;                          %%gravity constant

Kb=0.8;                        %%thermal conductivity of basin

Cw=4.18;                       %% specific heat constant of water KJ/kg-K

Kin=0.03;                      %%thermal conductivity of insulator here insulator is wool

Lin=0.07;                      %%thickness of insulation material

Lb=0.01;                       %%thickness of basin

hair=13.75;                    %% average heat transfer coefficient of air

V=4;                           %% velocity of air

Kw=0.62;                       %% thermal conductivity of water

alphaw=0.85;                   %%absorbity of water

alphab=0.68;                   %%absorbity of basin

kinevis=0.001;                 %%kinematic viscosity of water

meuw=0.00089;                  %% Dynamic viscosity of water

%% As we know the heat transfer takes place in three modes conduction, Convection and radiation. So here we write the equation for various mode of heat transfer coefficient
```

```
hradgw=Eeff*sigma*((tw^2)+(tg^2))*(tw+tg);
%% hradgw indicates the radiative heat transfer coefficient between the glass and water
hconwg=0.884*((tw-tg)+((Pw-Pg)*tw/(268900-Pw)))^(1/3);
%%hconwg indicates convective heat transfer coefficient between water and glass
hevapwg=0.016276*hconwg*(Pw-Pg)/(tw-tg);
%% this play major role in water evaporation hevapwg represents total evaporative heat transfer coefficient
hgw=hradgw+hconwg+hevapwg;
%%Total heat transfer coefficient between glass and water
hradgsky=eg*sigma*((tg^2)+(tsky^2))*(tg+tsky);
%%radiative heat transfer coefficient between glass and sky
hconga=2.8+3*V;
%% As here velocity of air is less than 5 so we write this equation if velocity of air is more than 5 then we  write 2.8+3.8V instead of above equation, hconga represents convective heat transfer coefficient between glass and air
hga=hradgsky+hconga; %% total heat transfer coefficient between glass and air
hba=(Kb/Lb)+((Kin*hair)/(Lin*hair+Kin));
%%Total heat transfer coefficient between basin and air
Gr=10*(0.00041)(tw-tb)(1/64)/((0.0000005958)^2);
%% here Gr indicates the Gershoff number and 0.00041 signify about expansion factor of water here we assume initially water temperature is more than basin if opposite happen then we simply write (Tb-Tw)
Pr=4.18*0.0005958/(Kw);  %%Kw %% Pr denotes Prandtl number and Kw indicates expansion factor of water
```

```
hbw=0.54*Kw*((Pr*Gr)^0.25); %% hbw Total heat transfer coefficient between basin and water

mass=(hevapwg*(tw-tg)*a1*3600/250000);

p=mass;

%%This mass is basically the value of water evaporated just after the installation  Ex at 9:00 AM

Ita=input('initial value of solar radiation');

k=Ita; %% value of solar radiation we put in a constant

%% this is solar radiation reading just after installation of solar still. Ex at 9:00 AM

%%Applying Energy balance on water taken as system, basin taken as system, glass taken as a system

%%On glass cover we get

%%hgw(Tw-Tg)= hga(Tg-Tamb)

%%here assume that inner glass temperature and outer glass temperature is same  and heat absorb between the glass cover is negligible so heat come in and heat goes out from glass cover is equal.

%%From here we find the value of Tg in term of Tw and Tamb

%%Tg=(hgwTw+hgaTamb)/(hgw+hga)

%%Applying energy conservation on basin taken as system

%%αbI(t)=hbw(Tb-Tw)+ hba(Tb-Tamb)

%%I(t) represent average solar radiation intensity in that duration

%%αb is absorptivity fraction of basin

%%tau is transmittivity fraction of basin

%%From here we get the value of Tb in term of Tamb and Tw

%%Tb= (αbI(t)+ hbwTw+ hbaTamb)/( hbw+ hba).

%%Now we apply energy balance equation on water taken as system
```

```
%%αwI(t)+ hbw(Tb-Tw)=MCw((d(Tw))/dt)+ hgw(Tw-Tg).

%%As we know heat equation in 1-D is written in the form of

                 %%(d(Tw))/dt+aTw=c

%%After putting value of Tb and Tg in term of Tw & Tamb  in energy balance equation of water, after rearranging and comparing it with heat equation in 1-D we get the value of a and c given below here a and c represent for the all parameter initial value

a=(1/(M*Cw))*(hba*hbw/(hbw+hba))+(hgw*hga/(hgw+hga));

c=(alphaw*Ita+(((hbw*alphab*Ita)+(hbw*hba*tamb))/(hbw+hba))+((hgw*hga*tamb)/(hgw+hga)))*(1/(M*Cw));

sum=0;

  %%we use loop for result for various time intervals

 for i=1:n

tw=input('enter the value of T water');

%%Here we give input of water temperature in every time interval

tamb=input('enter the ambient temperature');

%% here we give the input of ambient temperature

tg=((hgw*tw)+hga*tamb)/(hgw+hga);        %% By dunckle equation

tb=((k*alphab*tau)+(hbw*tw)+(hba*tamb))/(hbw+hba);

Pw=exp(25.317-(5144/tw));

Pg=exp(25.317-(5144/tg));

hradgw=Eeff*sigma*((tw^2)+(tg^2))*(tw+tg);

hconwg=0.884*((tw-tg)+(Pw-Pg)*tw/(268900-Pw))^(1/3);

hevapwg=0.016276*hconwg*(Pw-Pg)/(tw-tg);
```

```
hgw=hradgw+hconwg+hevapwg;

hradgsky=eg*sigma*((tg^2)+(tsky^2))*(tg+tsky);

hconga=2.8+3*V;

hga=hradgsky+hconga;

hba=(Kb/Lb)+((Kin*hair)/(Lin*hair+Kin));

Gr=10*(0.00041)(tb-tw)(1/64)/((0.0000005958)^2);

Pr=4.18*0.0005958/(Kw);

hbw=0.54*Kw*((Pr*Gr)^0.25);

mass=(hevapwg*(tw-tg)*a1*3600/250000);

sum=sum+mass;%% Mass extracted per time interval

if i<n

%%here we apply if else condition because initially just before the loop we take one value of solar
radiation

It=input('enter the value of solar radiation');

k=It;

else

end

 end

 cummulativemasss= sum+p;
```

Publications

❖ International Journal Publications

S. No.	Papers	Journal & Impact factor
1.	**V. K. Chauhan**, S. K. Shukla, J. V. Tirkey, and P. K. Singh Rathore, "A comprehensive review of direct solar desalination techniques and its advancements," J. Clean. Prod., vol. 284, p. 124719, Feb. 2021, DOI: https://doi.org/10.1016/j.jclepro.2020.124719	Cleaner Production **11.1**
2.	**V. K. Chauhan**, S. K. Shukla, and P. K. S. Rathore, "A systematic review for performance augmentation of solar still with heat storage materials: A state of art," J. Energy Storage, vol. 47, p. 103578, Mar. 2022, DOI: https://doi.org/10.1016/j.est.2021.103578	Journal of Energy Storage **9.4**
3.	**V. K. Chauhan** and S. K. Shukla, "Analytical and experimental study of performance of pyrex glass q-dot based passive solar still glass evaporator," Therm. Sci. Eng. Prog., vol. 34, p. 101387, Sep. 2022, DOI: https://doi.org/10.1016/j.tsep.2022.101387	Thermal Science Engineering progress **4.8**
4.	**V. K. Chauhan** and S. K. Shukla, "Experimental study of effect of glass cover tilt angle of solar still in winter season of India's composite climate," Therm. Sci. Eng. Prog., vol. 33, p. 101348, Aug. 2022, DOI: https://doi.org/10.1016/j.tsep.2022.101348	Thermal Science Engineering progress **4.8**
5.	**V.K. Chauhan**, S.K. Shukla, "Performance analysis of Prism shaped solar still using Black phosphorus quantum dot material and Lauric acid in composite climate: An experimental investigation", Sol. Energy. 253 (2023) 85–99. DOI: https://doi.org/10.1016/j.solener.2023.02.017	Solar Energy **6.7**

❖ National/International Conferences

1. 2nd International Conference on Water Technologies (ICWT - 2022) "Experimental and Theoretical Analysis of Q-Dot Coated Solar Still in Nocturnal Period" Oral Presentation, IIT Bombay, Dec 1 - Dec 2, 2022.

2. International Conference on Beyond Fossil fuels, "Experimental analysis of nocturnal performance of conventional solar still using quantum dot and PCM in tropical climate" Poster Presentation, IIT (BHU), July 2022.
3. 6th International Conference on Polygeneration, "Experimental investigation and study of effect of glass cover tilt angle of solar still in winter season" University of Zaragoza, Spain, October 2021, (ISBN: 978-84-09-35919-6), pg.439-453.