

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, July 2020**

**Course: Solar Thermal Technologies**  
**Program: M.Tech Renewable Energy Engineering**

**Semester: II**  
**Time 03 hrs.**

**Course Code: EPEC 7016**

**Max. Marks: 100**

**Instructions:**

1. Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.
2. Attempt all questions serially as per question paper.
3. Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.
4. Scan the whole answer script and check the resolution carefully before upload on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.
5. You are expected to be honest about each attempt which you make to progress in life

**SECTION A 40 Marks**

S. No.		Marks	CO																												
Q 1	<p>A cylindrical parabolic collector is used in New Delhi (<math>28^{\circ}35' N, 77^{\circ} 12' E</math> ). Estimate the beam radiation falling on aperture plane of this collector (LAT) on June10 for the tracking mode - I for following:</p> <p>(i) from 06:00 to 07:00 h (ii) from 10:00 – 11:00 h</p> <p>For tracking mode I, <math>\cos \theta = \sin^2 \delta + \cos^2 \delta \cos \omega</math></p> <table border="1"><thead><tr><th>Time (h)</th><th><math>I_b</math> (W/m<sup>2</sup>)</th><th>Time (h)</th><th><math>I_b</math> (W/m<sup>2</sup>)</th></tr></thead><tbody><tr><td>0630</td><td>110</td><td>1230</td><td>523</td></tr><tr><td>0730</td><td>240</td><td>1330</td><td>495</td></tr><tr><td>0830</td><td>333</td><td>1430</td><td>445</td></tr><tr><td>0930</td><td>424</td><td>1530</td><td>322</td></tr><tr><td>1030</td><td>495</td><td>1630</td><td>220</td></tr><tr><td>1130</td><td>550</td><td>1730</td><td>118</td></tr></tbody></table>	Time (h)	$I_b$ (W/m <sup>2</sup> )	Time (h)	$I_b$ (W/m <sup>2</sup> )	0630	110	1230	523	0730	240	1330	495	0830	333	1430	445	0930	424	1530	322	1030	495	1630	220	1130	550	1730	118	20	CO2
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NOTE : The submission time of the Question Paper Answer Sheet is 24 Hrs from the scheduled time (exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas).

No Submission will be entertained after 24 Hrs

Q 2	Describe followings for a thermochemical storage for a solar application a) Criteria used for judging the suitability of a thermochemical reaction b) Schematic representation of a thermochemical reaction c) Thermochemical storage reactions, temperatures of forward and reverse reaction and energy stored	20	CO3
<b>SECTION B 60 Marks</b>			
Q 3	A solar air heater is used for heating ambient air in a particular application. The characteristic parameters of the air heater are $FR(\tau\alpha)_{av} = 0.63$ , $F_R U_1 = 6.2 \text{ W/m}^2\text{-K}$ . If the solar flux incident on the plane of the collector is $705 \text{ W/m}^2$ , calculate the useful heat gain rate.	10	CO4
Q 4	As per IS 12933 of testing procedure of liquid solar flat plate collector, explain: a) Testing setup with help of diagram b) Principle measurement c) Consideration of steady state conditions	10	CO4
Q 5	Determine the sunset hour angle for Allahabad (longitude $81^\circ 58' \text{E}$ , latitude $24^\circ 25' \text{N}$ ) for following dates: January 1, March 22	10	CO1
Q 6	With the help of diagram, explain the working of low temperature power generation cycle using liquid flat plate collector.	10	CO5
Q 7	Briefly explain Evacuated tube collector.	4	CO2
Q 8	Briefly explain three characteristics zones of solar pond with help of diagram.	4	CO5
Q 9	Write short note on 'Cermets' - selective surface.	4	CO4
Q 10	For a cylindrical parabolic concentrator of 2.5m width, and 9m length, the outside diameter of the absorber tube is 6.5cm. Find the concentration ratio of the collector.	4	CO2
Q 11	Write short note on "Solar updraft tower power plant".	4	CO5

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