Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2022

Course:	**Solar PV Technologies**	**Semester**	**: 3rd**
Program:	**B Tech-RESE**	**Time**	**: 03 hrs.**
Course Code:	**EPEG 2019**	**Max. Marks: 100**	

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	A tube light consumes 320 watt-hours of electrical energy when used for 8 hours. Estimate the power rating of the tube light.	**4**	**CO1**
Q 2	A solar cell gives a current of 0.6 A and voltage of 0.5 V at maximum power point. What is the maximum power point of the solar cell?	**4**	**CO2**
Q 3	Explain the factors affecting Electricity Generated by a Solar Cell.	**4**	**CO2**
Q 4	Define and explain the following with neat diagrams: i) Solar azimuth angle ii) declination angle.	**4**	**CO3**
Q 5	Explain the working principle of MPPT in SPV system.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q 6	A solar cell having an area of 25 cm^2 gives a current of 0.85 A and voltage 0.55 V at maximum power point. The short circuit current is 0.9 A and open circuit voltage is 0.65 V. What is the Fill Factor, maximum power point and efficiency of the solar cell? Consider STC.	**10**	**CO2**
Q 7	What is target for National Solar Mission of India? Does solar power cause any pollution or damage to the environment?	**10**	**CO3**
Q 8	A SPV module having total area of 1.646 m^2 and gives a current of 8.08 A and voltage of 29.72 V at maximum power point. The short circuit current of the module is 8.48 A and open circuit voltage is 37.34 V. What is the fill factor, maximum power point and efficiency of the solar cell? Consider STC.	**10**	**CO4**
Q 9	What are the major environmental factors, those are responsible to scatter and reflect the solar irradiance? Explain the behavior of light generated current of p-n junction diode.	**5+5**	**CO4**

SECTION-C
(2Qx20M=40 Marks)

Q 10	Determine solar Time (ST) corresponding to 12:00 noon Indian Standard time (IST) (Longitude **81º54′ E**) on May 8, 1995 for New Delhi. (For required data, see appendix). Or, Estimate the monthly average daily global radiation on the horizontal surface at Nagpur (21.06 N, 79.03 E) during the month of March if the average sunshine hours per day is 9.2. Assume a=0.27 & b=0.50	**20**	**CO5**
Q 11	A. Calculate the Declination angle, local apparent time and hour angle for the collector located in Bombay, which is tilted at an angle of 30^0 with the horizontal and is pointing due south on October 1. B. What will be the angle of incidence in Mumbai in the afternoon (LAT) on 1 November on horizontal plane?	**10+10**	**CO5**

Appendix

Table-1: Latitude, Longitude and elevation for different places in India

Place	Latitude (ϕ)	Longitude (L_{loc})	Elevation (E_o)
Bangalore	12º 58′ N	77º 35′ E	921 m above msl
Bombay	18º 54′ N	72º 49′ E	11 m above msl
Jodhpur	26º 18′ N	73º 01′ E	224 m above msl
Mount Abu	24º 36′ N	72º 43′ N	1195 m above msl
New Delhi	28º 35′ N	77º 12′ E	216 m above msl
Simla	31º 06′ N	77º 10′ E	2202 m above msl
Srinagar	34º 05′ N	74º 50′ E	1586 m above msl
Calcutta	22º 32′ N	88º 20′ E	6 m above msl

Table-2: The Sun's equation of Time € (Minutes: second)

Month	1	8	15	22
Jan	-(3 : 16)	-(6 : 26)	-(9 : 12)	-(11 : 27)
Feb	-(13 : 34)	-(14 : 14)	-(14: 15)	-(13 : 41)
March	-(13 : 36)	-(11 : 04)	-(9 : 14)	-(7 : 12)
April	-(4 : 11)	-(2 : 07)	-(0 : 15)	(1 : 19)

May	2 : 50	3 : 31	3 : 44	3 : 30
June	2 : 25	1 : 15	-(0 : 09)	-(1 : 40)
July	-(3 : 33)	-(4 : 48)	-(5 : 45)	-(6 : 19)
August	-(6 : 17)	-(5 : 40)	-(4 : 35)	-(3 : 04)
Sept	-(0 : 15)	2 : 03	4 : 29	6 : 58
October	10 : 02	12 : 11	13 : 59	15 : 20
November	16 : 20	16 : 16	15 : 29	14 : 02
December	11 : 14	8 : 26	5 : 13	1 : 47

Table-3: The value of hour angle with time of the day (for Northern hemisphere)

Time of the day (Hours)	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Hour angle (degree)	-90	-75	-60	-45	-30	-15	0	+15	+30	+45	+60	+75	+90