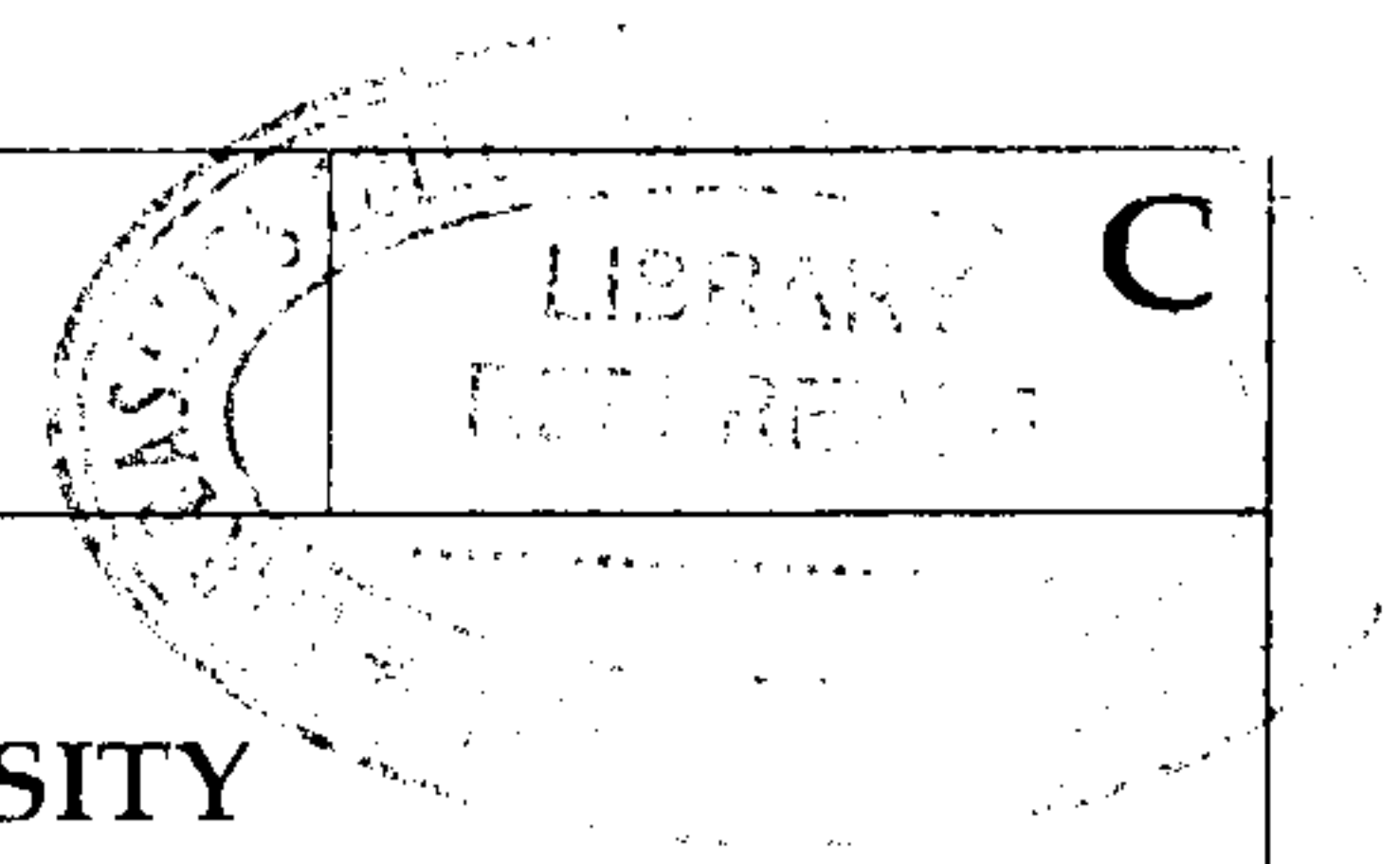


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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2019

ELECTRICAL&ELECTRONICS ENGINEERING

Stream: Power systems, Power Control and Drives, Power System and Control, Electrical Machines, Control System

01EE6412 NEW AND RENEWABLE SOURCES OF ENERGY

Answer any two full questions from each part

Limit answers to the required points.

Max. Marks: 60

Duration: 3 hours

PART A

1.	a.	What are renewable energy resources? Discuss their importance in India's energy requirement context.	[3]
	b.	Write notes on beam and diffuse radiation. Describe one method for measurement of diffuse radiation.	[3]
	c.	Determine the local apparent time corresponding to 11.30 IST on July 1, at Delhi ($28^{\circ} 35' N, 77^{\circ} 12' E$). The equation of time correction on July 1 is -4 minutes.	[3]
2.	a.	Derive an expression for angle made by the beam radiation to normal to a flat plate collector tilted at an angle of β with the horizontal and is pointing due south.	[3]
	b.	Find the hour angle at sunrise and sun set on June 21 for a surface inclined at an angle of 10° facing south at Mumbai ($19^{\circ} 07' N, 72^{\circ} 51' E$).	[3]
	c.	Compute the monthly hourly solar flux received on a flat plate collector facing due south having a slope of 18° . The collector is located at a place ($28^{\circ} 35' N, 77^{\circ} 12' E$) on 18 th day of October at 12 h(LAT) Given: $H_g = 2408 \text{ kJ/m}^2/\text{h}$, $H_d = 1073 \text{ kJ/m}^2/\text{h}$, Ground reflectivity $\rho = 0.25$ and $\omega = 7.5^{\circ}$	[3]
3.	a.	Discuss the effect of loss coefficients on the performance of a liquid flat-plate collector.	[3]
	b.	Explain the current voltage characteristics of solar cell. Obtain an expression for maximum conversion efficiency of a solar cell.	[3]

	c.	A photovoltaic system for supplying drinking water is installed in a village in Rajasthan. The water is pumped from a well from a depth of 48 m. The solar cells are made from single crystal silicon cell and the array consists of 18 modules. Each module consist of 36 numbers of solar cell having the specification (12.5cm x 12.5 cm.). Given that the inverter efficiency is 90 percent and pump motor set efficiency is 48 percent. Calculate the water discharge rate at noon when the global radiation incident normally on the cell is 945 W/m ²	[3]
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PART B

4.	a.	Establish the equation for the power extracted from ocean waves in terms of wavelength, amplitude, period and ocean water density.	[3]
	b.	Briefly explain the principle of working of wave energy conversion devices.	[3]
	c.	Describe with the help of a simple schematic diagram the process of an ocean thermal energy conversion based on steam cycle.	[3]
5.	a.	Compare the sequential operation modes of a tidal range power scheme and tidal stream power scheme.	[3]
	b.	A simple single basin type tidal power plant has a basin area of 22km ² The tide has range of 10 m. The turbine stops operating when the head on it falls below 3m. Calculate the average power generated during one filling/emptying process in MW if the turbine generator efficiency is 65% Given specific gravity of sea water is 1.025.	[3]
	c.	Distinguish between a tidal power plant and an OTEC power plant with reference to principle of operation	[3]

6	a.	Discuss various methods for estimating wind energy potential	[3]
	b.	A propeller wind machine has rotor diameter of 40 m. It is operating at location having wind speed of 35kmph and rotating at 20 rpm. Calculate theoretically the power which the machine can extract from the wind considering both wake rotation and effect of drag. Assume $\xi = .012$.	[6]

PART C

7.	a.	Explain a small hydro electric project installation with unique features. Discuss in detail about the design considerations for the turbines and generators for small hydro power plant.	[6]
	b.	Give a list of materials used for biogas generation. What are the techniques suggested for maintaining biogas production. Explain.	[6]
8.	a.	Describe in detail about factors affecting biogas production.	[4]
	b.	Describe a binary cycle system for liquid dominated system.	[4]
	c.	Explain design criteria for satellite based power stations.	[4]

9.	a.	Design a fuel cell for automotive vehicles and explain the principle of operation.	[6]
	b.	What are the different methods for hydrogen production? Describe the thermo chemical method for hydrogen production.	[6]