

Code No: RT41021

**R13**

**Set No. 1**

**IV B.Tech I Semester Regular Examinations, November - 2016**  
**RENEWABLE ENERGY SOURCES AND SYSTEMS**  
**(Electrical and Electronics Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Comment on the growth of the energy sector in India. [3]
- b) What are the important performance indices of a solar collector? Based on what features the performance of a solar collector can be evaluated? [4]
- c) Show that a wavelength of  $\lambda = 1 \mu\text{m}$  solar radiation corresponds to an energy of 1.24 eV. Give all assumptions made. [4]
- d) Draw the block diagram of wind electric system mentioning its basic components. [4]
- e) Write the expressions for kinetic energy and power output for a wave. [4]
- f) Write a short note on bio-gasifier. [3]

**PART-B (3x16 = 48 Marks)**

2. a) Derive the expression for total radiation on an inclined surface. Show that a horizontal surface receives no ground-reflected radiation. [8]
- b) Define solar constant. What is its standard value? [8]
3. Discuss the construction and working of Liquid flat plate collector with a neat sketch. Explain the various parameters that affect the performance of collector. [16]
4. a) List out various methods to track Maximum Power Point of solar PV systems and explain about P&O technique. [10]
- b) Write a short note on sizing of PV system and its storage. [6]
5. a) Discuss in detail the operation and control of a wind turbine. How the variations of wind velocity and its directions are taken care? [8]
- b) A horizontal axis wind turbine is installed at a location having free wind velocity of 15 m/s. the 80m diameter rotor has three blades attached to the hub. Find the rotational speed of the turbine for optimal energy extraction. [8]
6. a) State the basic principle of tidal energy production and write major components of tidal power plant. [8]
- b) What are the advantages and limitations of wave energy conversion? [8]
7. a) Explain the analysis of the energy content and its extraction for a hot dry rock type Geothermal resource. [8]
- b) Describe the principle of working of a fuel cell with reference to  $\text{H}_2 - \text{O}_2$  cell. [8]



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**PART-A (22 Marks)**

1. a) Define diffused and global radiation. [4]
- b) Why orientation is needed in concentrating type collectors? Explain. [4]
- c) How do you determine the internal series resistance of a solar cell? [3]
- d) Write a technical note on MPPT of Wind energy. [4]
- e) The basin area of a tidal power plant is  $20 \times 10^6 \text{ m}^2$ . The tidal range is 8m, calculate the energy generated in kWh. [4]
- f) What are the different biomass energy resources and what is the energy yield from each of them. [3]

**PART-B (3x16 = 48 Marks)**

2. Briefly discuss the following: [16]
 

i) solar irradiance	ii) solar constant	
iii) extraterrestrial radiations	iv) terrestrial radiations	
3. a) Deduce the expression for collector heat-removal factor. List out various parameters that effect the performance of collector. [8]
- b) Write the advantages and disadvantages of concentrating collectors over flat-plate types of solar collectors. [8]
4. a) Explain the term fill factor and its importance as a performance parameter for a solar cell. [8]
- b) If the saturation current is  $10^{-8} \text{ Am}^{-2}$ , calculate and draw the I-V characteristic as a graph to 0.2 V. [8]
5. a) Describe the electrical layout of a typical wind farm by means of single line diagram. State the essential equipment. [8]
- b) Discuss about power coefficients of windmills. [8]
6. a) Derive the expression for energy and power in single basin tidal system. [8]
- b) List out various wave-energy conversion devices. [4]
- c) Define small, mini and micro hydro power. [4]
7. a) Discuss the energy analysis of a hot Aquifer type Geothermal resource. [8]
- b) Mention the application of fuel cells and explain anyone application. [8]

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**Set No. 3**

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*Answer ALL sub questions from Part-A*  
*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Define beam, diffused and global radiation [4]
- b) What are the main applications of solar pond? [3]
- c) What is the importance of the term fill factor as a performance parameter for a solar cell? [3]
- d) Explain the significance of  $C_p - \lambda$  curves. [4]
- e) What type of turbine is best suited for micro hydel plant? Describe it. [4]
- f) What are the environment impacts of geothermal energy? [4]

**PART-B (3x16 = 48 Marks)**

2. a) What is the status of non-conventional energy sources in India and what is their future prospectus? [6]
- b) Define the following:  
i) surface Azimuth angle    ii) solar Azimuth angle  
iii) hour angle    iv) angle of latitude    v) declination [10]
3. a) How the performance of liquid flat plate collector can be analyzed. Discuss in detail. [10]
- b) Describe different methods of sun tracking. [6]
4. a) Discuss the step-by-step procedure to execute P & O algorithm for tracking the maximum power from the sun. [10]
- b) Taking a solar power content of  $1W/cm^2$  at the space-station location, calculate the area of solar panels required at 20% efficiency of conversion for power of 2000MW, 5000MW, 10000MW and 15000MW. [6]
5. a) Derive an expression for power extracted from wind. Write a short note on Betz criterion. [10]
- b) Write a technical note on selection of generator for WECS. [6]
6. Explain with sketches the various methods of tidal power generation. What are the limitations of each method? [16]
7. a) Derive an expression for emf, free energy, potential, power output and efficiency of a fuel cell. [10]
- b) Write a short note on bio-gas plant. [6]

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**PART-A (22 Marks)**

1. a) What is solar time and why it is different from the standard clock time of a country. [4]
- b) List the options adopted for enhancing the efficiency of solar collectors. [3]
- c) Give test specifications for PV systems. [4]
- d) Draw the  $C_p$ - $\lambda$  curves and explain its significance. [4]
- e) What are the various types of turbines considered for use in micro hydro resources? [4]
- f) Classify fuel cells and differentiate between Fuel Cell and Battery. [3]

**PART-B (3x16 = 48 Marks)**

2. a) Describe the main features of various types of renewable energy resources. [6]
- b) Calculate the number of daylight hours at Bangalore on 21 June and 21 December in a leap year. The latitude of Bangalore is  $12^{\circ}58'N$ . [10]
3. a) With suitable schematic, describe the construction and working of solar pond based electric-power plant with cooling tower. [8]
- b) What are the main advantages of flat-plate solar collector? [8]
4. a) Draw and explain an equivalent circuit of a practical solar PV cell. [8]
- b) What is the implication of cell mismatch in a solar module? [4]
- c) What is the significance of fill factor? [4]
5. Derive the expression for power extracted from wind considering Betz model of a wind turbine. What is the maximum theoretical power that can be extracted and under what condition? [16]
6. a) Explain about single basin arrangement in tidal power generation. [8]
- b) Describe the concepts of converting wave energy into mechanical or electrical energy. [8]
7. a) What are biomass conversion technologies? Draw a schematic diagram to explain various conversion technologies and products. [8]
- b) List out various types of Geothermal resources. [8]

