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National Institute of Technology Hamirpur

B.Tech –Semester 5

End Semester Examination

MS-371: Materials for Renewable Energy (Open Elective)

Duration: 180 Minutes **Max. Marks: 50**

Instructions:

- *This question paper consists of 2 pages and 9 questions.*
- *Attempt all the questions.*
- *The diagram or flow chart drawn should be neat and properly labelled.*

1. Briefly explain the following terms with suitable diagram (wherever required):

   (a) Fill factor
   (b) Light trapping mechanism
   (c) Superalloys
   (d) Microbial fuel cell (MFC's)
   (e) Quantum dot solar cells
   (f) Smart grid technology
   (g) Solar pond

   (14 Marks)

2. Briefly explain the general types of radiation effects on materials. **(3 Marks)**

3. Define 'biofuels', and explain its classification in brief. Also mention some of the biggest ethical disadvantages associated with the use of biofuels. **(4 Marks)**

4. As a nuclear materials scientist, you have been approached by an industry actively working towards the development of following components of nuclear reactors. Specify your recommendation for the materials selection with the adopted selection criteria:

   (a) Moderators
   (b) Control rods
   (c) Shielding materials

   (6 Marks)

(237)

5. With a neat and clean diagram, explain the working principle/mechanism of a typical polymer solar cell. **(3 Marks)**

6. Following are some of the key components of a typical thermal power plant. Write down the key functions of these components and suggest an appropriate material to design these components with an appropriate rational behind your recommendation:

   (a) Turbine

   (b) Deaerator **(6 Marks)**

   (c) Economiser

7. Explain 'Photovoltaic (PV) Effect'. State the advantages and disadvantages of PV solar energy. **(3 Marks)**

8. A beam of 5 MeV protons with current density 105 /cm^2·sec is incident to the face of a silicon wafer. Find the number of ion pairs formed per unit volume, and the fraction of Si atoms experiencing ionization. **(3 Marks)**

9. What is a fuel cell? With the suitable diagram, describe the components, functioning, and key reactions of a typical **H_2 O_2 fuel cell**. Briefly mention the advantages and disadvantages associated with the use of fuel cells. **(1+1+2+1+ 2+1 = 8 Marks)**

OR

What is a **Dye Sensitized Solar Cell (DSSC)**? With the suitable diagram, describe the components/materials, functioning, and key reactions of a typical DSSC. Briefly mention the advantages and disadvantages associated with the use of these cells. **(1+1+2+1+ 2+1 = 8 Marks)**
