**📘 CSE407: Green Computing – Midterm Exam & Preparation Guide (Current Semester)**

This document has been updated to ensure maximum clarity, accessibility, and effectiveness for students preparing for the upcoming midterm exam.

**1. Overall Exam Structure**

* **Total Midterm Marks:** 10 marks [Theory Component]
* **Exam Format:** You will answer **TWO** scenario-based questions.
* **Marks per Question:** Each question is worth **5 marks**.
* **Total Time:** As per the standard midterm schedule.

**2. Syllabus & Teaching Materials**

For this midterm, you will be tested on the following two Green Computing principles:

i. Energy Efficiency

ii. Waste Management

Your preparation should be based on the rewritten textbook sections provided in class, which are organized into three parts for each section:

* **0.1:** One-line real-world scenario summary
* **0.2:** Two-line elaboration
* **0.3:** Key concepts, applications, and relevance

To perform well, you are strongly advised to study all three parts (0.1, 0.2, and 0.3) for every section related to the two principles above.

**3. Question Design and Answer Structure (5 Marks per Question)**

Each of the two questions will present a real-world situation or problem. You are expected to structure your answer in two parts:

|  |  |  |
| --- | --- | --- |
| **Part** | **Max Marks** | **How to Score Well** |
| **A. Principle Identification & Justification** | 2 | Clearly name the single most relevant Green Computing principle (*Energy Efficiency* or *Waste Management*). Support your choice with direct reasoning and concepts from the textbook material. |
| **B. Application & Recommendation** | 3 | Apply the chosen principle to the specific details and constraints of the scenario. Provide a clear, practical recommendation and explain *how* and *why* your solution is effective, using structured, textbook-aligned reasoning. |

**4. Sample Questions & Model Answers**

The following are **examples** to help you understand the question format and the depth of reasoning expected. The actual exam questions will be different but will follow the same structure.

**Sample Question 1**

**Title:** Optimizing a 24/7 Call Center for a Startup

**Scenario:** A new customer support startup operates a 24/7 call center with 50 employees working in three shifts. To save on initial costs, they furnished the office with powerful but older-generation desktop computers that were purchased cheaply. After three months, the electricity bills are alarmingly high, and the IT team reports significant heat generation in the server room, requiring constant air conditioning. The management needs a strategy to drastically reduce running costs without disrupting their 24/7 operations.

**Instruction to Student:**

* **A.** Identify the primary Green Computing principle that best addresses the startup's high operational costs and justify your choice using textbook concepts.
* **B.** Based on the principle, recommend a specific, actionable strategy for the startup to implement. Explain how your recommendation would lower both energy consumption and cooling requirements.

**Model Answer for Question 1**

**Part A: Principle Identification & Justification**

The primary Green Computing principle that addresses this situation is **Energy Efficiency**.

**Justification:** The scenario's core problems—"alarmingly high" electricity bills and "significant heat generation"—are direct consequences of high energy consumption. The textbook (Section 5.6) states that the true cost of a device includes its lifetime running costs, primarily power and cooling. The startup's older desktops are inefficient, leading to high direct power draw. This, in turn, creates a secondary energy cost for cooling, as every watt consumed by servers requires more watts for air conditioning. This aligns perfectly with the principle of Energy Efficiency, which focuses on reducing energy consumption to cut both costs and carbon emissions simultaneously (Section 2.1).

**Part B: Application & Recommendation**

**Recommendation:** The startup should adopt a two-pronged strategy:

1. **Device Fleet Transition:** Gradually replace the inefficient desktops with smaller, more energy-efficient devices like thin clients or modern tablets.
2. **Power Management Policy:** Implement and enforce a strict power management policy for all devices.

**Explanation:** This strategy directly applies the principle of Energy Efficiency.

* **How it works:** Transitioning to tablets or thin clients addresses the root of the problem. As stated in the textbook (Section 6.1), a green device is small, durable, and has low power usage. Tablets consume significantly less energy than desktops, immediately reducing the primary electricity bill. This transition also lowers the thermal load in the office, which directly reduces the secondary cost of air conditioning. A power management policy (e.g., ensuring idle machines enter sleep mode) captures additional savings, creating "negawatts"—the cheapest energy is the energy never used (Section 2.1).
* **Why it's effective:** This solution "serves many masters" (Section 8.1). It delivers rapid financial ROI through lower utility bills (Section 8.2), reduces the company's carbon footprint, and improves the work environment by lowering ambient heat. It is a strategic, sustainable solution that turns a financial crisis into a green computing victory.

***Analysis of the Answer (How to Think Like This)***

* ***Connects the dots:*** The answer doesn't just say "high bills mean energy problem." It explicitly links the scenario's details (bills, heat) to specific textbook concepts (running costs, power + cooling).
* ***Goes beyond the obvious:*** The recommendation isn't just "buy new computers." It's a strategic, two-part plan (transition + policy) that shows a deeper understanding of implementation.
* ***Uses textbook language:*** Phrases like "negawatts," "serves many masters," and "running costs" show that the student has absorbed the course material and can apply its vocabulary correctly.
* ***Explains the "How" and "Why":*** The answer clearly separates how the solution works from why it is the most effective choice, demonstrating structured analytical thinking.

**Sample Question 2**

**Title:** A Municipality's E-Device Refresh Program

**Scenario:** A city municipality is planning to upgrade all computers across its public libraries and administrative offices. They have a budget for 500 new all-in-one PCs. The procurement officer has two quotes: one from "Vendor A," who offers a 15% discount but has no stated policy on device disposal, and another from "Vendor B," who is slightly more expensive but is certified under the EU’s WEEE Directive and guarantees a free take-back and recycling program for all old and new devices at the end of their lifecycle. The city is facing growing landfill shortages.

**Instruction to Student:**

* **A.** Identify the primary Green Computing principle that should guide the procurement officer's decision and justify why it is critical in this context, using textbook concepts.
* **B.** Recommend which vendor the municipality should choose and explain how this choice aligns with the principle. Describe the long-term environmental and ethical benefits of your recommendation.

**Model Answer for Question 2**

**Part A: Principle Identification & Justification**

The primary Green Computing principle that should guide this decision is **Waste Management**.

**Justification:** The core of the scenario is the end-of-life handling of 500 PCs, which directly relates to the challenge of e-waste. The textbook (Section 5.8) emphasizes that effective e-waste management involves "full lifecycle responsibility" from manufacturers, not just disposal by consumers. Vendor A's lack of a policy ignores this responsibility, risking that the old devices will contribute to landfill shortages and toxic leachate. Vendor B's certified take-back program, aligned with the WEEE Directive, demonstrates a commitment to this principle, ensuring the devices are handled safely and sustainably.

**Part B: Application & Recommendation**

**Recommendation:** The municipality must choose **Vendor B**, despite the higher initial cost.

**Explanation:** This choice is a strategic application of the Waste Management principle.

* **How it aligns:** Choosing Vendor B institutionalizes responsibility. The textbook (Section 6.1) states that a green buyer must assess a supplier's "long-term take-back support" and "transparency in disposal." Vendor B provides this assurance. By paying a small premium, the municipality is not just buying computers; it is investing in a guaranteed, ethical disposal solution. This prevents the 500 old (and eventually, 500 new) PCs from ending up in landfills where they could release hazardous materials like lead and mercury into the groundwater (Section 5.8).
* **Long-term benefits:** The environmental benefits are clear: reduced landfill use and prevention of toxic pollution. The ethical benefits are equally important: it ensures the city is not contributing to the global problem of e-waste being unsafely dismantled in developing countries. Furthermore, this decision sets a powerful precedent for future public procurement, signaling to the market that sustainability is non-negotiable. It is a long-term investment in the city's environmental health and ethical reputation.

***Analysis of the Answer (How to Think Like This)***

* ***Identifies the core conflict:*** The answer correctly pinpoints that the choice isn't about price, but about responsibility for waste. It frames the problem around the key concept of "lifecycle responsibility."
* ***Uses specific evidence:*** It references the WEEE Directive and the dangers of toxic leachate, showing a detailed understanding of the textbook material beyond just surface-level ideas.
* ***Thinks long-term:*** The recommendation considers the "long-term environmental and ethical benefits," demonstrating mature, strategic thinking. It considers the impact not just on the 500 old PCs, but the 500 new ones in the future.
* ***Connects action to impact:*** The answer explains how a simple procurement decision can "set a precedent" and "signal to the market," showing an understanding of how individual choices contribute to systemic change. This is the highest level of cognitive reasoning.