

Examination Feedback for EEE124 – Energy in the Home  
Spring Semester 2014-15

**Feedback for EEE124 Session: 2014-15**

**Feedback:** Please write simple statements about how well students addressed the exam paper in general and each individual question in particular including common problems/mistakes and areas of concern in the boxes provided below. Increase row height if necessary.

**General Comments:**

The EEE124 examination was presented to the students via MOLE. It was conducted under normal examination conditions. There were a total of 50 questions. Most questions required the student to select the appropriate answer(s) from lists provided (multiple choice; multiple answer; true/false; list ordering). A few questions required the student to type a short answer. Below are examiners comments on the questions that were answered poorly by a sizeable proportion of the cohort.

**Specific comments:**

*What does the term CO<sub>2</sub>e mean?*

The global warming potential (GWP) of a gas mixture in terms of the equivalent (e) amount of carbon dioxide (CO<sub>2</sub>) that would have the same GWP, hence CO<sub>2</sub>e. For example GWP(methane) = 34 and GWP(CO<sub>2</sub>) = 1, hence 1/34 volume of CH<sub>4</sub> has same GWP as 1 volume of CO<sub>2</sub>.

**GLW**

*A batch of (In,Ga)N light emitting diodes produce radiation at a wavelength of 400 nm. Describe briefly how they can be used to provide lighting for an office.*

Comment:

Two important points:

We want white light (400-700nm) for an office, hence need to add phosphors on top of LEDs.

LEDs produce narrow beam of light, therefore need to add diffusers to illuminate over wide angle.

**GLW**

*Which of the following reactions best describes the burning of methane in air?*

Correct answer:  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$

Methane (CH<sub>4</sub>) burns by reacting with oxygen (O<sub>2</sub>) to produce carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O), hence:  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$

**GLW**

*A coal-fired boiler generates 6000 GJ of energy per hour. Describe where all of this energy goes.*

Coal-fired power stations have efficiency  $\eta = 40\%$ , ie 40% (= 2400GJ/h) of power turned into electricity. Remaining power (60 %) is lost. Loss mechanisms: hot gas from boilers (10% = 600 GJ/h); waste steam (50% = 300GJ/h).

**GLW**

*A heat pump has a coefficient of performance (COP) of 4. It can extract a maximum 2 kW from a room. How much power (W) does the heat pump consume?*

$\text{COP} = \text{heat moved (W)} / \text{power used (W)}$ , hence power =  $2000/4 = 500 \text{ W}$

**GLW**

*Briefly outline the purpose of an earth wire. Include a description of the different ways in which a*

<p><i>home can be earthed.</i></p> <p>Comment: A large number of incorrect reasons were given here resulting in the average mark only being about 50% of the available score</p>	<b>IS</b>
<p><i>The typical load in a kitchen consists of a kettle at 10 A; a toaster at 9 A and all other electrical equipment at 15 A. What is the most appropriate miniature circuit breaker rating for the kitchen radial loop? Note: a particularly wrong answer will incur a 50 % negative mark.</i></p> <p>Correct answer: 20 A</p> <p>Common incorrect answer: 16 A</p> <p>Comment: It looks like students selected the first amperage above the sum of all electrical equipment (15A) rather than apply the diversity equation.</p>	<b>IS</b>
<p><i>Describe the principle of operation of a residual circuit current device (RCCD).</i></p> <p>Comment: Nearly all answers to this question were incorrect. I am unsure as to why, since it was covered in some detail in both the lectures and associated notes. The incorrect answers seemed to fall into two categories:</p> <ol style="list-style-type: none"> <li>1. Those appearing to invent an answer based on the term “residual current”</li> <li>2. Those getting confused with parts of the course on energy generation and storage</li> </ol>	<b>IS</b>
<p><i>Which type of wind turbine is the most efficient?</i></p> <p>Horizontal axis wind turbine (HAWT) is more efficient than Vertical axis (VAWT) or Savonius rotor VAWT. HAWT allows pitch adjustment of blades to optimise collection of wind energy. For HAWT there is no need for the blades to back track through the airflow, whereas for VAWT there is. HAWT tower is generally taller than VAWT, giving access to stronger winds.</p>	<b>DAS</b>
<p>What is the best efficiency (%) you can expect theoretically from an ideal single junction silicon solar cell? Answer: 33%</p>	<b>JPRD</b>
<p><i>At what residual battery capacity is an electric vehicle battery generally considered no longer viable for vehicle use? Answer: 80 %</i></p>	<b>DAS</b>

John David / Ian Sandall / Dave Stone / Gavin Williams