Examination Feedback for EEE124 – Energy in the Home
Spring Semester 2013-14

Feedback for EEE124 Session: 2013-2014

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 60 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 is the maximum electrical power P that can be generated from an hydro-electric power station that has a head of 50 m and a water flow rate of 70 m^3/h?

Correct answer: P = 70 x 1000 x 9.8 x 50 = 34.3 MW

Common incorrect answer: *P* = 70 x 9.8 x 50 = 34 kW

Comment: 1m^3 water has mass of 1000 kg, not 1 kg! **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 petrol (octane) in air?

Correct answer: 2 C_8H_{18} + 25 O_2 −> 16 CO_2 + 18 H_2O

Common incorrect answer: C_8H_8 + 10 O_2 −> 8 CO_2 + 4 H_2O

Comment: The chemical formula for octane is C_8H_{18} not C_8H_8! **GLW**

A coal-fired power station generates 1 MW at 40 % efficiency. The steam from the turbine is recovered using cooling water which has an inlet temperature of 20 °C and a flow rate of 100 m^3/h. What is the outlet temperature of the cooling water? Show your working and state any assumptions that you have made.

Comment: Generally answered well, but there were also a few crazy answers!

η = 40 %, hence losses = 60 % - assume 10 % as hot gas from boiler and 50 % as waste steam.
Hence power in waste steam = (50/40) x 1 = <u>1.25 MW.</u>
Hence waste energy in 1 hour E_{1h} = 1.25×10^6 x 60 x 60 = 4.5×10^9 J
Energy that can be extracted by water = C_v (T_{out} –T_{in}) vol
Hence T_{out} = (E_{1h}/C_v vol) + T_{in} = ($4.5 \times 10^9 / 4.2 \times 10^6$ x 100) + 20 = <u>30.7 °C</u> **GLW**

'The coefficient of performance (COP) for an air conditioning unit is always less than 1'. TRUE or FALSE?

Correct answer: FALSE

Comment: Answered badly! COP = $1/\eta = T_{hot}/(T_{hot}-T_{cold})$ = Energy moved / Energy consumed.

It can be (and usually is) greater than 1. For example, an air conditioning unit can use 1 kW of electricity to move 4 kW of heat. **GLW**

Briefly outline the purpose of an earth wire. Include a description of the different ways in which a home can be earthed.

Comment: A large number of incorrect reasons were given here resulting in the average mark only being about 50% of the available score **IS**

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.

Correct answer: 20 A

Common incorrect answer: 16 A

Comment: It looks like students selected the first amperage above the sum of all electrical equipment (15A) rather than apply the diversity equation. **IS**

Describe the principle of operation of a residual circuit current device (RCCD).

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:

1. Those appearing to invent an answer based on the term "residual current"

2. Those getting confused with parts of the course on energy generation and storage **IS**

Consider part of a typical UK electricity distribution network, in which three homes are connected from the final transformer at the nearest sub-station. From the list below select all of the correct statements about such a network. Incorrect answers will incur a negative mark.

Comment: There appears to be some confusion between line and phase voltages with around half the answers being incorrect. **IS**

The power available from the wind is proportional to...?

Correct answer: Wind velocity cubed **DAS**

The world record efficiency for a multi-junction solar cell has now exceeded 44 %' True or False?

Correct answer: FALSE **JPRD**

In which year was the first Hybrid Car produced?

Correct answer: 1900 **DAS**

John David / Ian Sandall / Dave Stone / Gavin Williams