國立雲林科技大學
九十一學年度研究所碩士班入學考試試題

系所：電機系
科目：工程數學

(1) Find the solution for the following equation. (15%)

$$\frac{dy}{dx} + y = x, \quad y(0) = 4$$

(2) Find the general solution for the following differential equation.

$$y'' - 2y' - 3y = 4x - 5 + 6xe^{2x} \qquad (20\%)$$

(3) Find the following problem by using the Laplace Transform. (15%)

$$y'' - 6y' + 9y = t^2 e^{3t}, \quad y(0) = 2, \quad y'(0) = 17$$

(4) Solve the integral equation $f(t) = 3t^2 - e^{-t} - \int_0^t f(\tau) e^{t-\tau} d\tau$ (15%)

(5) Find values of a, b, and c such that the following system of linear equations has

(i) exactly one solution, (5%)

(ii) an infinite number of solutions, (5%)

(iii) no solution. (5%)

$$\begin{aligned} x + 5y + z &= 0 \\ x + 6y - z &= 0 \\ 2x + ay + bz &= c \end{aligned}$$

(6) $A = \begin{bmatrix} 1 & -4 \\ -2 & 8 \end{bmatrix}$

(i) Find the eigenvalues and corresponding eigenvectors of A. (10%)

(ii) If possible, find a matrix P and D such that $D = P^{-1}AP$ is diagonal. (10%)

國立雲林科技大學
九十一學年度研究所碩士班入學考試試題

系所：電機系
科目：科技英文

I.(30%) Reading comprehension 1

(1)Current moves from a point of high potential energy to one of low potential. It can only do so if there is a path for it to follow. This path is called an electric circuit. All circuits contain four elements: a source, a load, a transmission system and a control.

The source provides the electromotive force. This establishes the difference in potential which makes current flow possible. The source can be any device which supplies electrical energy. For example, it may be a generator or a battery.

The load converts the electrical energy from the source into some other form of energy. For instance, a lamp changes electrical energy into light and heat. The load can be any electrical device.

The transmission system conducts the current round the circuit. Any conductor can be part of a transmission system. Most systems consist of wires. (2)It is often possible, however, for the metal frame of a unit to be one section of its transmission system. For example, the metal chassis of many electrical devices are used to conduct current. Similarly the body of a car is part of its electrical transmission system.

The control regulates the current flow in the circuit. (3)It may control the current by limiting it, as does a rheostat, or by interrupting it, as does a switch.

Study figure 1. In this simple flashlight circuit, the source comprises three 1.5V cells in series. The load is a 0.3W bulb. Part of the transmission system is the metal body of the flashlight, and the control is a sliding switch.

Compare figure 2. The function of this circuit is to operate a television camera aboard a space satellite. Here the source is a battery of solar cells. A solar cell is an electric cell which converts sunlight into electrical energy. The load is the television camera. The transmission system is the connecting wires. The control is a relay actuated by transmissions from ground control. Although the function of this circuit is much more complex than that of the flashlight, it too consists of the four basic elements.

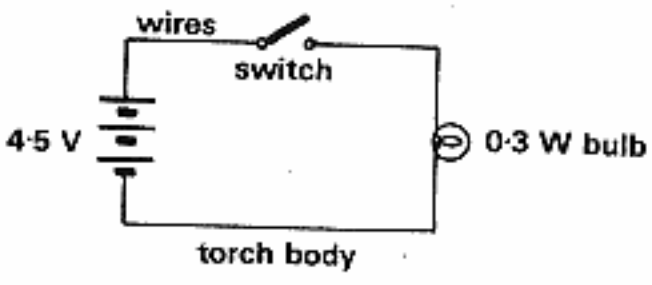

FIGURE 1

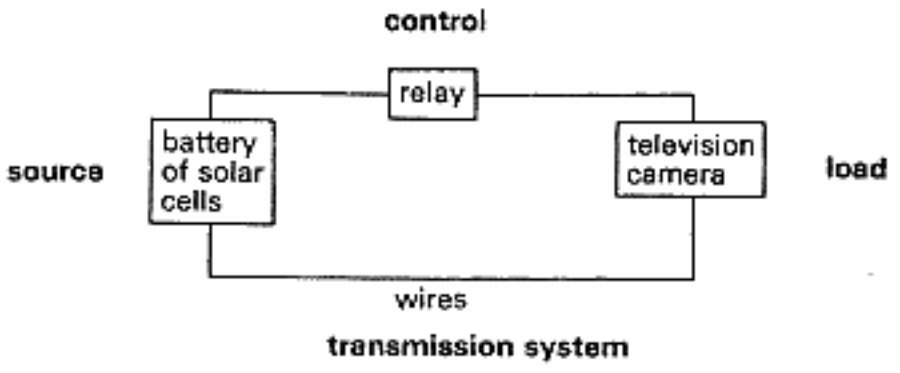

FIGURE 2

A. What do the pronouns in boldface in these sentences referred to?

1. Current moves from a point of high potential energy to **one** of low potential. (4%)
   (a) current (b)energy (c)a point (c)potential
2. It is often possible, however, for the metal frame of a unit to be one section of **its** transmission system. (5%)

(a) the metal frame's (b) the unit's (c) the circuit's (d) the conductor's

3. **It** may control the current by limiting it, as does a rheostat, or by interrupting it, as does a switch. (5%)

(a) current (b) control (c) current flow (d) circuit

B. Decide if these statements are true or false. Quote from the passage to support your decisions.

1. A difference in potential is required before current can flow in a circuit. (2%)
2. A generator is a source of electromotive force. (2%)
3. The current flow in the satellite circuit is regulated by a relay. (2%)
4. Transmission systems must consist of wires. (2%)
5. The flashlight circuit differs basically from the satellite circuit. (2%)
6. A rheostat may be used as a control. (2%)
7. The source in the satellite circuit is a solar cell. (2%)
8. The load in the flashlight circuit is a bulb. (2%)

II. (40%) Reading comprehension 2

If two crystals of a semiconductor material, one of p-type and one of n-type, are joined together, a pn junction is formed. This junction can be used as a rectifier and is known as a pn junction diode.

Figure 3 illustrates what happens when a voltage is applied across a silicon pn junction diode. The first quadrant of the graph shows the **characteristics** of the diode when the source is connected with the positive to the p-side of the junction and the negative to the n-side. In other words, the diode is forward biased. With forward bias, the current will continue to rise with increased voltage but eventually a point will be reached where the diode is destroyed by heat.

The third quadrant shows the characteristics when the source is connected with the positive to the n-side and the negative to the p-side. When the diode is reverse biased, there is almost no current flow. The junction is therefore a good rectifier: it conducts well in one direction and almost not at all in the other. However there is a small reverse leakage current. This leakage current remains **substantially** constant until what is known as breakdown voltage (Vb) is reached. At this point there is a **sharp** increase in the reverse current. This sudden increase is called the Zener effect.

Normal diodes are never operated in the breakdown region but Zener diodes are designed to make use of the breakdown **phenomenon**. Because any slight increase in voltage beyond the breakdown point causes a large increase in current. Zener diodes are often used as a kind of overspill to protect sensitive circuits from **fluctuations** in the power supply.

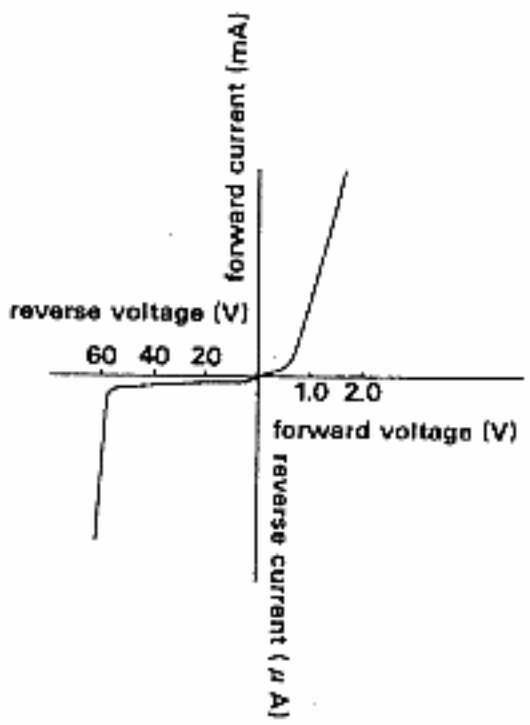

FIGURE 3

國立雲林科技大學
九十一學年度研究所碩士班入學考試試題

系所：電機系
科目：科技英文

A. Select a word from the three alternatives given which is most similar in meaning to the word in boldfaces as it is used in the passage: (20%)

1. **characteristics**
   (a) typical behavior (b) voltage figures (c) graph
2. **Substantially**
   (a) almost (b) greatly (c) hardly
3. **Sharp**
   (a) slight (b) steep (c) cutting
4. **Phenomenon**
   (a) voltage (b) effect (c) result
5. **Fluctuations**
   (a) rises and falls (b) increases (c) failures

B. Complete this description of the current-voltage characteristics of a silicon diode. Use the passage and Figure 3 to help you. (10%)

(例 1): the current increases slowly.

At first, when a forward voltage is applied, …(例 1). When the forward voltage has reached about 600 mV, …(1). If the forward voltage is further increased, …(2). …(3)only a very small leakage current flows. When the breakdown voltage is reached, …(4). After the breakdown point, any further increase in reverse voltage causes…(5).

C. Decide if these statements are true or false. Quote from the passage to support your decisions. (10%)

1. The first quadrant of the graph shows the characteristics of the diode in forward bias.
2. For forward voltages over 600mV, the diode conducts well.
3. When the source is connected with the negative to the n-side and the positive to the p-side, the diode conducts badly.
4. When a reverse voltage is first applied, a diode conducts badly.
5. Zener diodes are never used beyond breakdown point.

III. (30%)英翻中

1. The development of electrical engineering and computer science has traditionally involved the combined efforts of persons with a wide range of skills and interests, and future development will demand further cross-disciplinary collaboration. (15%)

2. Photovoltaic(PV, 太陽光發電) gives us domestic reserves of energy that we will never deplete. PV semiconductor materials are abundant. And sunshine, the "fuel" for PV, is something we can never overtax or squander. (15%)