1. Answer all questions in your answer sheet.

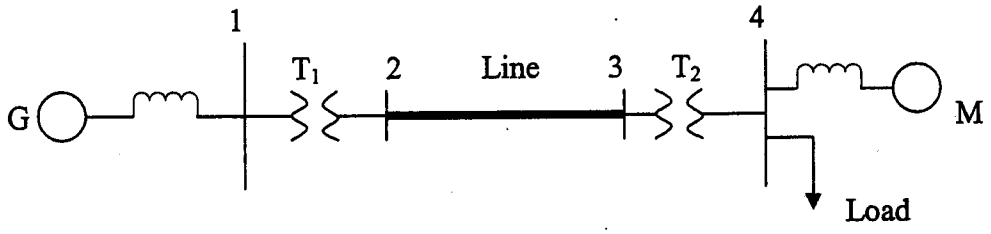
A. Define the term 'bolted fault'. (3%)

B. State the conditions of an electric power system for which the augmented Y_{bus} matrix (i.e. the indefinite Y_{bus} matrix) is singular. (3%)

C. Which common model is used for most load buses in a power flow study (choose the best answer): (A) PQ bus (B) PV bus (C) Swing bus (D) TCUL bus. (3%)

D. Define the 'frequency sensitive load' and make an example of this kind in your real life. (3%)

2. The one-line diagram of a three-phase power system is depicted below.



The nameplate ratings for the power equipment are given as follow:

Generator G: 90MVA	11kV	X=15%
Transformer T_1: 100MVA	11Δ/121Y kV	X=10%
Transformer T_2: 90MVA	138Y/69Δ kV	X=15%

Transmission Line: j15Ω

Operating condition:

Motor M: 50MVA	60kV	X=15% 0.8 power factor lagging
Load: 30MVA	60kV	0.65 power factor lagging

Select a common base of 100MVA and 121kV

A. Draw an impedance diagram and label all impedances including Generator, Motor, and Load in per unit. (8%)

B. Take bus 4 voltage as reference, determine the Motor current, and Load current in actual unit kA. (6%)

C. Determine the internal emfs in kV for the Generator and Motor. (6%)

D. A capacitor of negligible resistance is connected in parallel with Load to improve the power factor to 0.8 lagging. Determine the capacitance in μF for the capacitor. (4%)

(背面仍有題目,請繼續作答)

3. An engineering process has inputs $x = (x_1,x_2)^T$ and outputs $y = (y_1,y_2)^T$ and is modeled by the function

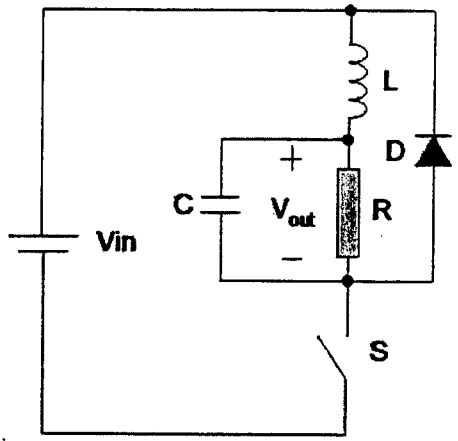
$$y_1 = f_1(x_1,x_2) = 0.1x_1x_2 + x_1^2 + 5.5$$
$$y_2 = f_2(x_1,x_2) = x_2^2 - 0.1x_1x_2$$

A. Find the best linear approximation to the process about the operating point $(x_1,x_2) = (1,2)$. (6%)

B. Define $(\Delta x_1, \Delta x_2) = (x_1-1, x_2-2)$ and $(\Delta y_1, \Delta y_2) = (y_1-f_1(1,2), y_2-f_2(1,2))$. From the linear approximation you find in (A), derive the relationship between $(\Delta x_1, \Delta x_2)$ and $(\Delta y_1, \Delta y_2)$ using the linear model (i.e. write the relationship using the Jacobian matrix). (4%)

C. What do the entries in the Jacobian tell you about controlling the output of the process with the input near $(x_1,x_2) = (1,2)$? (4%)

4. Derive the DC voltage ratio, Vout/Vin, of the CCM DC-DC converter, as shown below. (10%) Plot the current and voltage waveforms of the inductor L. (10%)



5. A 200-kVA, 13,200V/2,200V, 60Hz, single-phase transformer has the following test data:

	Volts	Amps	Watts	Frequency	Volts
Open Circuit	2,200	3.1	1550	60	12,800
Short Circuit	210	90.9	2500	60	

Determine the parameters of the T-equivalent circuit when referred to the low voltage winding. (20%)

(背面仍有題目,請繼續作答)

6. A circuit, as shown below, is a typical layout which might be encountered in a micro-processor instrumentation system. The wire used in the connection between the transformer and the switching power supply is #14 gauge with a resistance of 2.5 ohms/1000ft measured at 60 Hz. The distance between the source voltage (97~132 VAC) and the transformer is negligible.
The following data applies:

Vin is between 97 and 132 volts AC at 60Hz.
I_1=5.0 amps I_2=0.5 amps　I_3=0.5 amps
Switching power supply efficiency = 75%
Minimum input voltage to switching power supply is 15VAC
Transformer turns ratio can vary by ±5%.
Calculate the maximum distance D between the transformer and the switching power supply. (10%)