*請依題號順序作答

一、多選擇題(30%，每題 10%，不倒扣，請於試卷內之「選擇題作答區」依序作答)

1. Noise is an unavoidable element of all measurements. It is important to understand the noise source and find ways to minimize noise effects. Which of the following statement is TRUE?
(A) The noise mechanism can be categorized into three stages: noise source, noise coupling mechanism and sensor or signal conditioning circuit. (B) The capacitive coupling is due to the magnetic field generated by current flowing through a conductor. (C) To minimize the noise effect, we can use shielding cable and grounded at the source end and the instrument end. (D) The twisted-pair wire can minimize the effect of capacitive coupling. (E) Notch filter can be used for canceling noise interference caused by power lines.

2. Practical operational amplifiers (op-amp) are not ideal devices but exhibit a number of limitations that should be take into consideration. Which of the following is TRUE for Practical Op Amp?
(A) If the short-circuit output current limitation I_{SC} is 50mA, we should design a load resistance R_L<100Ω to prevent the signal distortion of output voltage, V_o = 5sin(ωt). (B) In a practical op-amp, the product of closed-loop gain and bandwidth is constant, which is determined by the product of open-loop gain and cut-off frequency. (C) The range of practical op-amp output voltage is generally limited by the external DC voltage supplies. (D). The smaller the Common-mode rejection ratio (CMRR), the better the practical op-amp is. (E) Slew rate is an important parameter when we use the practical op-amp under DC mode.

3. Fig. 1 is a standard 2nd order filter. Which of the following statement is TURE?
(A) It is a bandpass filter if the output voltage is connected across the resistor. (B) Under a fixed capacitor and inductor value, we should increase the resistance value to get a higher quality factor. (C) We cannot change the resonant frequency of this circuit by adjusting the resistance value. (D) The bandwidth value is only correlated with the quality factor. (E) The higher the quality factor, the sharper the phase response slope at the resonant frequency.

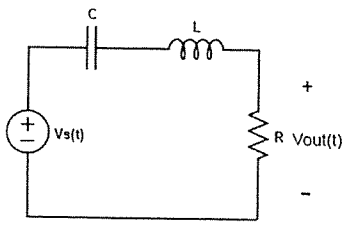

Figure 1

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二、非選擇題 (70%)

1. (10%) A typical DC power supply is made up several components, such as Bridge rectifier, Step-down transformer, Regulator, Filter. Please draw the circuit of above components and complete the DC power supply model.

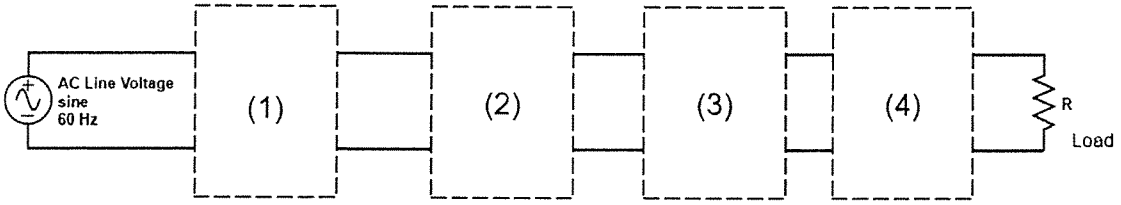

Figure 2

2. (10%) Find *i* across the voltage source in the circuit of Fig. 3.

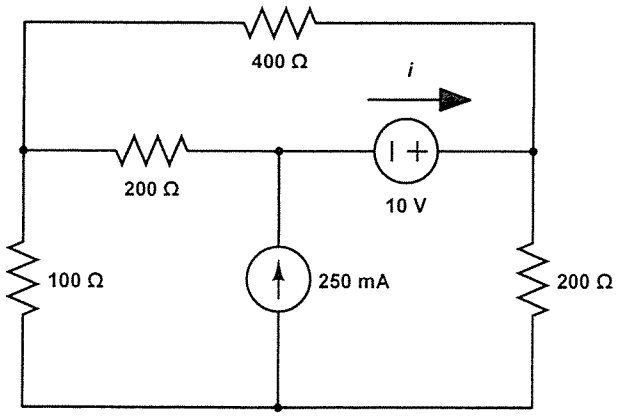

Figure 3

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3. (15%) If the switch in the circuit shown in Fig. 4 is closed at t = 0s. Determine the current through the inductor and the voltage across the capacitor and across R_1 after the circuit has returned to a steady state. V_s = 15 V, C =130 μF, L = 30 mH, R_1 = 3 kΩ, R_2 = 12 kΩ,

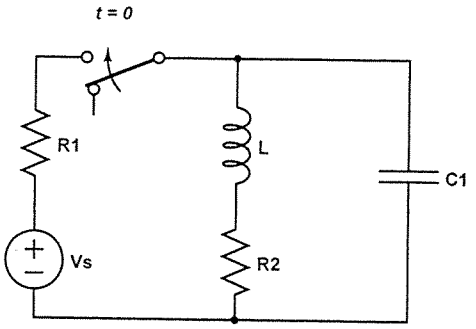

Figure 4

4. (15%) The inverting amplifier shown in Fig. 4 can be used as a low-pass filter. (a) Please derive the frequency response of the circuit. (b) If R_1 = 50 kΩ, R_2 = 150 kΩ and C =0.2 μF, compute the attenuation decibels at ω = 1000rad/s. (c) compute gain and phase at ω = 100rad/s

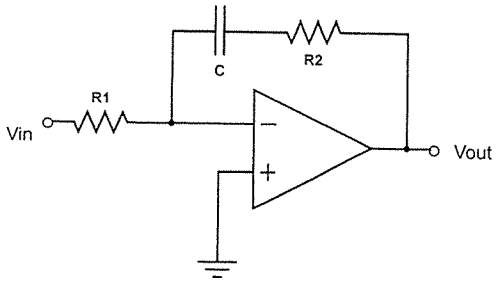

Figure 5

5. (20%) The circuit shown in Fig. 6 is a common-collector (also called emitter follower) amplifier stage implemented with an *npn* silicon transistor. Determine V_{CEQ} at the DC operating or Q point. Given that V_{cc} = 12 V, β =130, R_1 = 80 kΩ, R_2 = 20 kΩ, R_s = 0.7 kΩ, R_E = 0.5 kΩ, R_L = 16 kΩ,

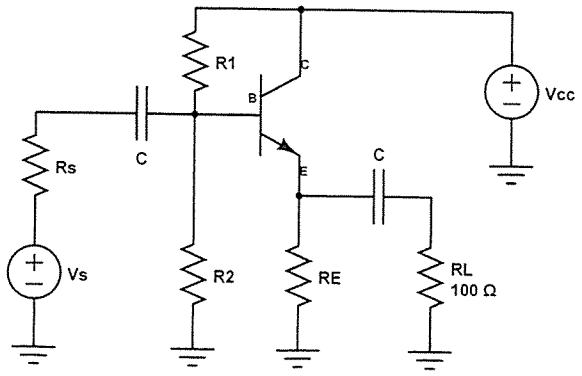

Figure 6

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