



# BBC4102 A

Joint Programme Examinations 2021/22

BBC4102 Introduction to Electronic Systems

Paper A

Time allowed 2 hours

**Questions 1~ 6 are for All Students.**  
**Questions 7~ 8 are for only Classes 1~16.**  
**Questions 9~10 are for only Classes 17~22.**

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Complete the information below about yourself very carefully.

QM student number

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BUPT student number

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Class number

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**NOT allowed: electronic dictionaries.**

## INSTRUCTIONS

1. You must not take answer books, used or unused, from the examination room.
2. Write only in black or blue pen **and in English**.
3. Do all rough work in the answer book – **do not tear out any pages**.
4. If you use Supplementary Answer Books, tie them to the end of this book.
5. Write clearly and legibly.
6. **Read the instructions on the inside cover.**

## Examiners

Hongxiang Wang, Minglun Zhang, Dong Liang, Yong Zuo, Jinnan Zhang, Hongtao Zhang, Daquan Yang

## Instructions

### Before the start of the examination

- 1) Place your BUPT and QM student cards on the corner of your desk so that your picture is visible.
- 2) Put all bags, coats and other belongings at the back/front of the room. All small items in your pockets, including wallets, mobile phones and other electronic devices must be **placed in your bag in advance. Possession of mobile phones, electronic devices and unauthorised materials is an offence.**
- 3) Please ensure your mobile phone is switched off and that no alarm will sound during the exam. **A mobile phone causing a disruption is also an assessment offence.**
- 4) Do not turn over your question paper or begin writing until told to do.

### During the examination

- 1) You must not communicate with or copy from another student.
- 2) If you require any assistance or wish to leave the examination room for any reason, please raise your hand to attract the attention of the invigilator.
- 3) If you finish the examination early you may leave, but not in the first 30 minutes or the last 10 minutes.
- 4) For 2 hour examinations you may **not** leave temporarily.
- 5) For examinations longer than 2 hours you **may** leave temporarily but not in the first 2 hours or the last 30 minutes.

### At the end of the examination

- 1) You must stop writing immediately – **if you continue writing after being told to stop, that is an assessment offence.**
- 2) Remain in your seat until you are told you may leave.

6.21考试

全计算题 给电路图求解电路

指定方法求解电路 → 实在不会用其他方法能解出也可

△求解电路的方法 务必熟悉

允许带计算器 (正弦稳态电路)  
→ 只有计算功能

一共8道题

KCL, KVL, 欧姆定律, (基础, 不会单独拿来考查)

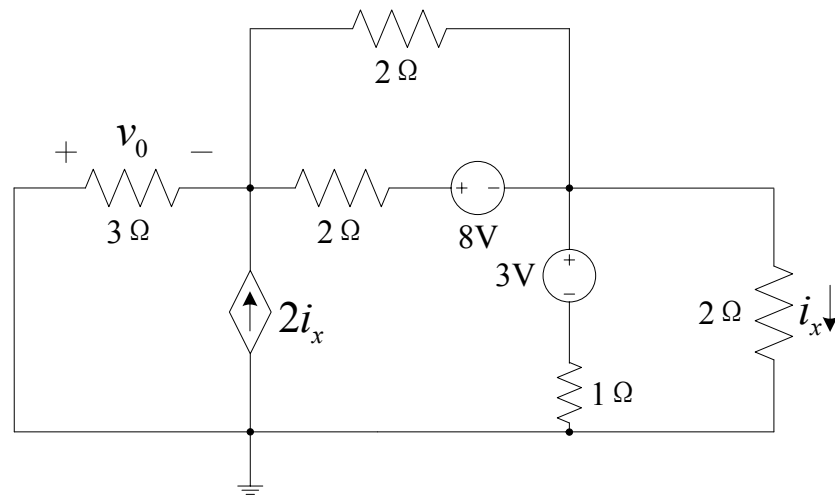
电阻电路 源变换, 叠加法, 戴维诺电压, 网孔节点, 运放(一般两个)  
动态电路 三要素法, 正弦稳态电路, 类似电阻电路

梳理学过的所有方法  
每类做2~3题  
完全搞明白



**Question 2: 12 Marks**

Use the Node-Voltage method to find the value of  $v_0$  in Figure 2.

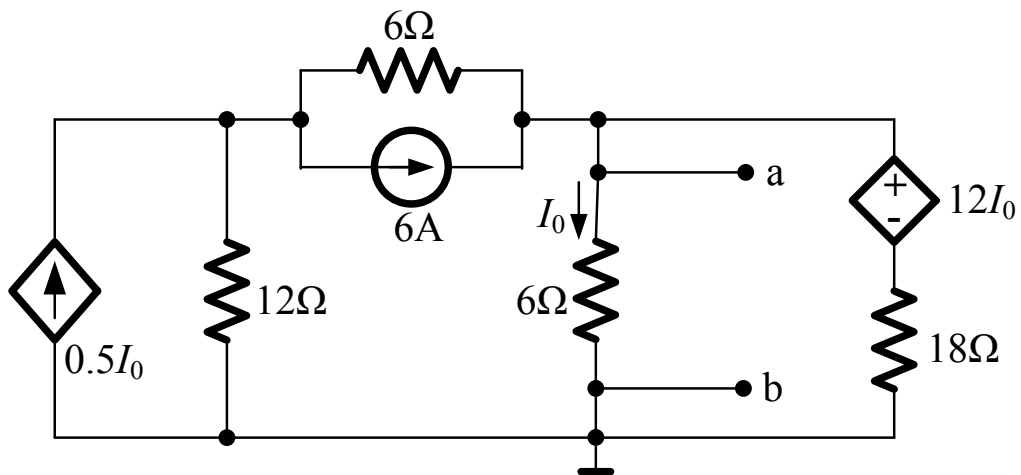


### Figure 2

[illegible]

**Question marking:**

Find the Thévenin equivalent circuit with respect to the terminals a and b in the circuit shown in Figure 3.

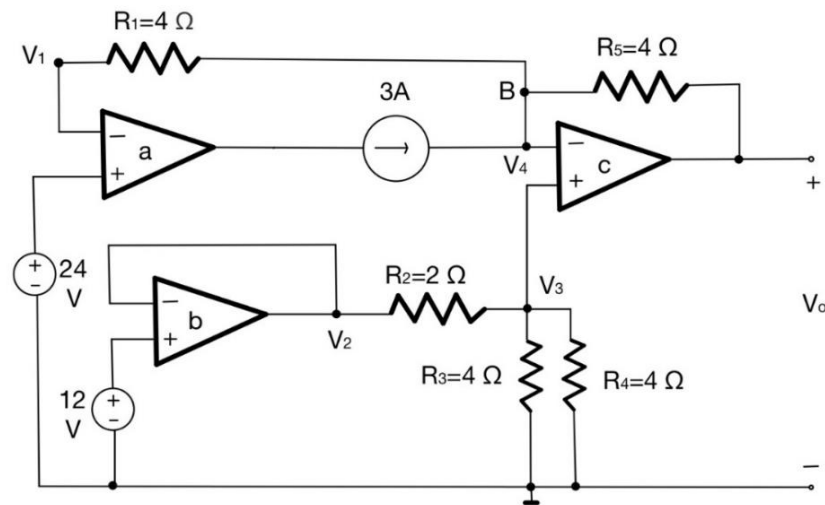
[illegible]

[illegible]

**Question marking:**

**Question 4: 12 Marks**

The operational amplifiers in the circuit shown in Figure 4 are ideal. Find the voltage  $V_o$ .



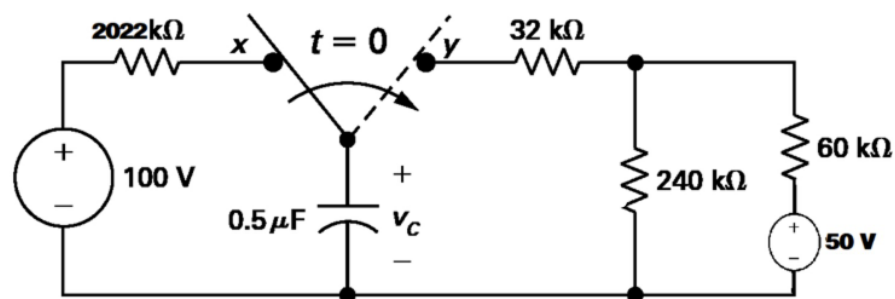
### Figure 4

	Do not write in this column
	<b>12 marks</b>

**Question marking:**

The switch in the circuit shown in Figure 5 has been in position x for a long time. At  $t = 0$ , the switch moves instantaneously to position y.

(b) if  $V_{c(t)} = \frac{1}{2} V_{c(0^+)}$ , find  $t$ . (4 Marks)



### Figure 5

[illegible]

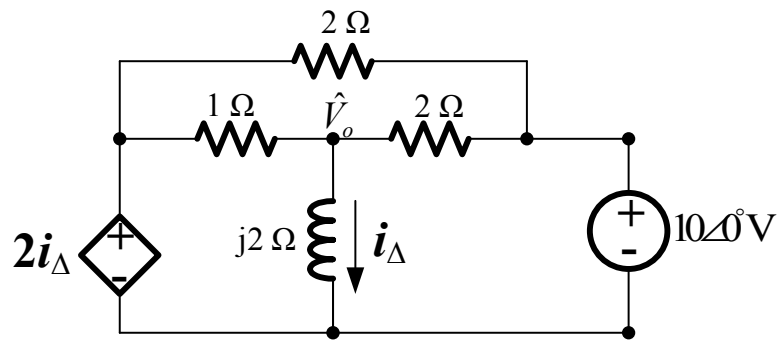


[illegible]

**Question marking:**

**Question 6: 13 Marks**

Please use the node voltage method to find the voltage  $\hat{V}_o$  in the circuit in Figure 6.



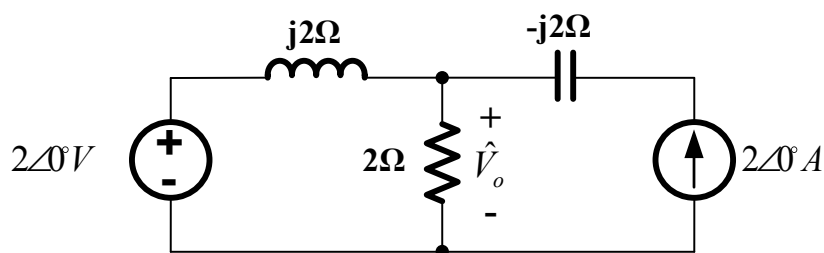
### Figure 6

[illegible]

**Question marking:**

**Question 7: 13 Marks – for Classes 1 ~ 16 only**

Determine the voltage  $\hat{V}_o$  in Figure 7 with superposition method:

**Figure 7**

	Do not write in this column
	13 marks

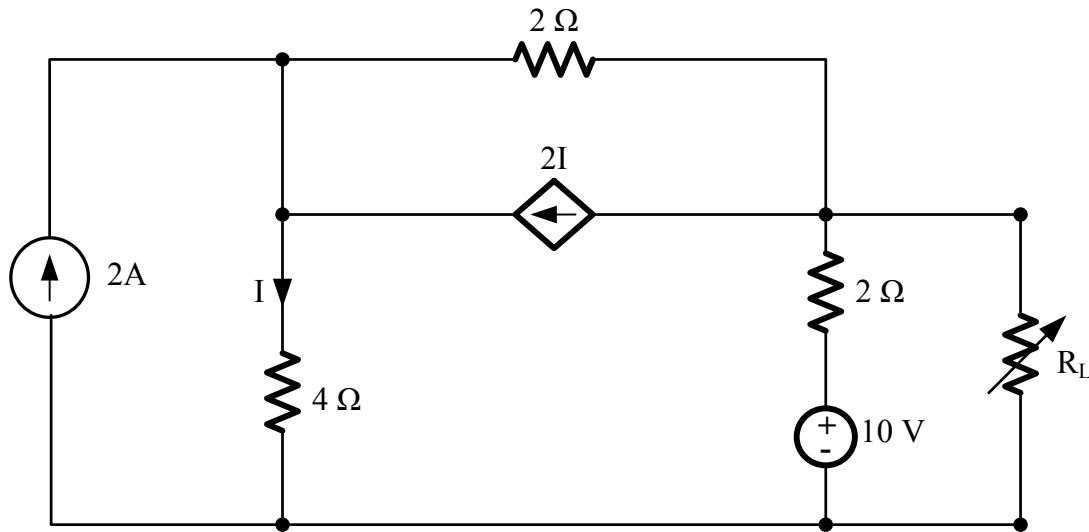
**Question marking:**

**Question 8: 13 Marks – for Classes 1 ~ 16 only**

The variable resistor ( $R_L$ ) in the circuit in Figure 8 is adjusted for maximum power transfer to  $R_L$ .

(a) Find the numerical value of  $R_L$ . (12 Marks)

(b) Find the maximum power transferred to  $R_L$ . (1 Marks)



### Figure 8

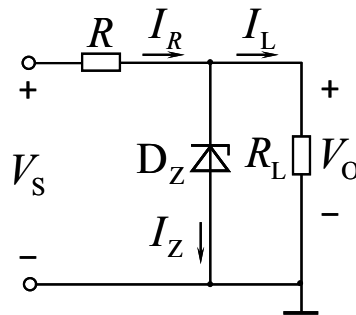
[illegible]

[illegible]

**Question marking:**

**Question 9: 8 Marks – for Classes 17 ~ 22 only**

In the circuit shown in Figure 9,  $V_s = 15\text{V}$ ,  $R_L = 1\text{k}\Omega$ . For the Zener diode D, the regulation voltage  $V_Z = 5\text{V}$ , the maximum regulation current  $I_{Z\text{max}} = 40\text{mA}$ , and the minimum regulation current  $I_{Z\text{min}} = 20\text{mA}$ . Determine the maximum and minimum values of the resistor  $R$ .



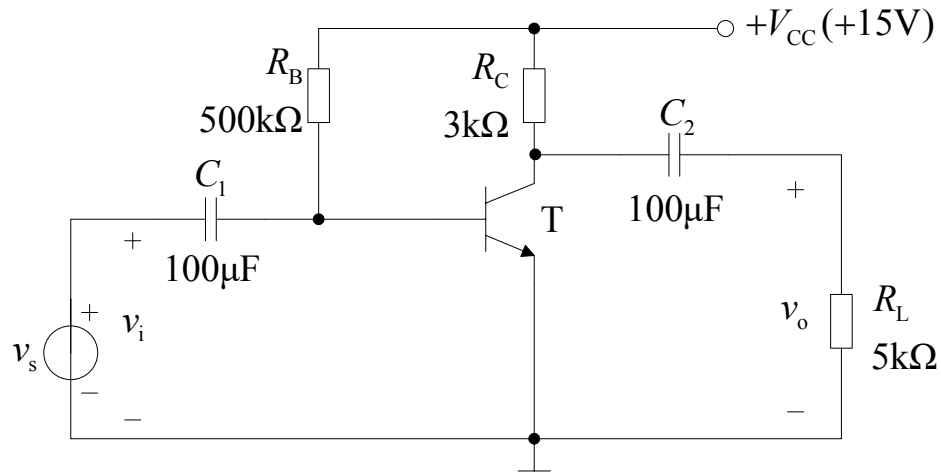
### Figure 9

[illegible]

**Question marking:**

The common-emitter BJT circuit is shown in Figure 10,

(2) Assume  $r_{bb'} = 100\Omega$  and  $r_{ce} = \infty$ , draw its small-signal hybrid- $\pi$  equivalent circuit, and calculate the BJT equivalent resistance  $r_{b'e}$  and voltage gain  $A_v$ . (9 Marks)



**Figure 10**

[illegible]

[illegible]

**Question marking:**



[illegible]

[illegible]

[illegible]

[illegible]