

**SULIT**



**KEMENTERIAN PENDIDIKAN TINGGI  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR**

**SESI I : 2025/2026**

**DEE30163: ELECTRONIC CIRCUITS**

**TARIKH : 06 DISEMBER 2025**

**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

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Kertas soalan ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A: Subjektif (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**SECTION A: 80 MARKS*****BAHAGIAN A: 80 MARKAH*****INSTRUCTIONS:**

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

***ARAHAN:***

*Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab SEMUA soalan.*

**QUESTION 1*****SOALAN 1***

CLO1

- (a) List **FOUR (4)** types of sinusoidal oscillator circuits.  
*Senaraikan EMPAT (4) jenis litar pengayun sinusoidal.*

[4 marks]

[4 markah]

CLO1

- (b) Explain the operation of a bridge rectifier during the positive and negative half-cycles of AC voltage with the aid of a simple diagram showing the current flow through the diodes.  
*Terangkan operasi jambatan penerus (bridge rectifier) semasa separuh kitaran positif dan separuh kitaran negatif voltan AC dengan bantuan gambarajah yang menunjukkan aliran arus melalui diod.*

[6 marks]

[6 markah]

CLO1 (c)

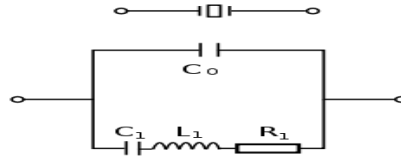
Figure A1 (c) / *Rajah A1 (c)*

Figure A1 (c) shows the crystal equivalent circuit. If the values of  $L = 4\text{H}$ ,  $C_1 = 530\text{pF}$ ,  $R = 5\text{k}\Omega$  and  $C_0 = 0.85\text{ nF}$ . Calculate the series and parallel resonant frequency of the crystal.

*Rajah A1 (c) menunjukkan litar persamaan kristal. Jika nilai  $L = 4\text{H}$ ,  $C_1 = 530\text{pF}$ ,  $R = 5\text{k}\Omega$  and  $C_0 = 0.85\text{ nF}$ . Kirakan frekuensi ayunan sesiri dan selari untuk kristal tersebut.*

[10 marks]

[10 markah]

**QUESTION 2****SOALAN**

- CLO1 (a) Name the block diagram of a DC Power Supply in Figure A2 (1).  
*Namakan blok rajah bagi Bekalan Kuasa DC dalam Rajah A2 (1).*

Figure A2(1) / *Rajah A2 (1)*

[4 marks]

[4 markah]

- CLO1 (b) The block diagram of an operational amplifier consists of three main blocks which are the Differential Amplifier, Gain Amplifier Stage, and Push-Pull Output Stage. Explain the function of each block briefly.  
*Rajah blok bagi penguat operasi (operational amplifier) terdiri daripada tiga blok utama iaitu Differential Amplifier, Gain Amplifier Stage, dan Push-Pull Output Stage. Terangkan secara ringkas fungsi setiap blok tersebut.*

[6 marks]

[6 markah]

- CLO1 (c) Express the output voltage equation ( $V_o$ ) with a drawing of the circuit of Non-Inverting Amplifier. Hence calculate the output voltage if  $R_F = 10k\Omega$ ,  $R_{IN} = 5k\Omega$  and input voltage =  $1mV_{p-p}$ .  
*Tunjukkan persamaan voltan keluaran dengan melukis litar Penguat Bukan Alikan. Seterusnya kirakan voltan keluaran jika  $R_F = 10k\Omega$ ,  $R_{IN} = 5k\Omega$  dan voltan masukan =  $1mV_{p-p}$ .*

[10 marks]

[10 markah]

**QUESTION 3****SOALAN 3**

- CLO1 (a) State **FOUR (4)** characteristics of an Ideal Operational Amplifier.  
*Nyatakan EMPAT (4) ciri-ciri Penguat Operasi Ideal*
- [4 marks]  
[4 markah]
- CLO1 (b) Timer 555 is an extremely stable integrated circuit that can operate as an Astable Multivibrator and Monostable Multivibrator. With the aid of a diagram, compare Astable and Monostable Multivibrators.  
*Timer 555 ialah litar bersepadu yang sangat stabil dan boleh beroperasi sebagai Astable multivibrator dan Monostable Multivibrator. Dengan bantuan rajah, bandingkan antara Astable dan Monostable Multivibrator.*
- [6 marks]  
[6 markah]
- CLO1 (c) A 555 timer is connected as an Astable Multivibrator. A 0.01 $\mu$ F which is used as a noise divertor is connected to pin 5 and is grounded. If a frequency and duty cycle of 30 kHz and 75% respectively are required at the output. Calculate the values of resistors when a 0.1 $\mu$ F capacitor is used.  
*Pemasa 555 disambungkan sebagai Multivibrator Astabil. 0.01 $\mu$ F yang digunakan sebagai penapis bunyi disambungkan ke pin 5 dan dibumikan. Jika frekuensi dan kitaran tugas 30 kHz dan 75% masing-masing diperlukan pada output. Kira nilai perintang- perintang apabila pemuat 0.1 $\mu$ F digunakan.*
- [10 marks]  
[10 markah]

**QUESTION 4****SOALAN 4**

- CLO1 (a) Describe **FOUR (4)** applications of filter circuits.  
*Terangkan EMPAT (4) kegunaan litar penapis.*
- [4 marks]  
[4 markah]
- CLO1 (b) Explain **THREE (3)** differences between Passive Filter and Active Filter.  
*Terangkan TIGA (3) perbezaan di antara Penapis Pasif dengan Penapis Aktif.*
- [6 marks]  
[6 markah]
- CLO1 (c) With the aid of RC high pass filter diagram, calculate the cut off frequency of the filter if the value of  $R = 250\Omega$  and  $C = 50\text{nF}$ .  
*Lukiskan gambar rajah RC high pass filter. Kemudian, kirakan cut off frequency bagi penapis jika nilai  $R = 250\Omega$  dan  $C = 50\text{nF}$ .*
- [10 marks]  
[10 markah]

**SECTION B: 20 MARKS*****BAHAGIAN B: 20 MARKAH*****INSTRUCTIONS:**

This section consists of **ONE (1)** essay question. Answer the question.

***ARAHAN:***

*Bahagian ini mengandungi SATU (1) soalan esei. Jawab soalan berikut.*

**QUESTION 1*****SOALAN 1***

In the real world, digital audio systems such as music players, smartphones, and computer sound cards use a Digital-to-Analog Converter (DAC) to transform digital data into analog signals that can be sent to speakers. One common method in electronic circuit design is the R2R ladder DAC, which is widely used because it requires only two resistor values and is easy to implement. With the aid of a 4-bit R-2R ladder circuit diagram with given values of  $R_f = R = 20 \text{ k}\Omega$ , step size = 15mV and  $V_{ref} = 5\text{V}$ , calculate the full-scale voltage, percentage resolution and analogue output voltage corresponding to digital input code 1011<sub>2</sub>.

*Di dalam dunia sebenar, sistem audio digital seperti pemain muzik, telefon pintar, dan kad bunyi komputer menggunakan Penukar Digital-ke-Analog (DAC) untuk menukarkan data digital kepada isyarat analog yang boleh dihantar ke pembesar suara. Salah satu kaedah biasa dalam reka bentuk litar elektronik ialah DAC rantaian tangga R-2R, yang banyak digunakan kerana hanya memerlukan dua nilai perintang dan mudah dilaksanakan. Dengan bantuan rajah litar R-2R 4-bit dengan nilai yang diberi  $R_f = R = 20 \text{ k}\Omega$ , saiz langkah (step size) = 15 mV dan  $V_{ref} = 5 \text{ V}$ , hitungkan voltan skala penuh (full-scale), peratus resolusi dan voltan keluaran analog yang bersesuaian dengan kod input digital 1011<sub>2</sub>.*

[20 marks]  
[20 markah]

**SOALAN TAMAT**

BIL	LIST OF FORMULA
1.	$f = \frac{1}{2\pi RC\sqrt{2N}}$
2.	$f = \frac{1}{2\pi\sqrt{LC}}$
3.	$CMRR = \frac{A_D}{A_C}$
4.	$CMRR_{dB} = 20 \log_{10} \frac{A_D}{A_C}$
5.	$A_V = \frac{V_O}{V_i}$
6.	$A_V = -\frac{R_f}{R_{in}}$
7.	$A_V = 1 + \frac{R_f}{R_g}$
8.	$V_o = -\left[\frac{R_f}{R_1}(V_1) + \frac{R_f}{R_2}(V_2) + \dots + \frac{R_f}{R_n}(V_n)\right]$
9.	$V_o = \frac{R_2}{R_1}(V_2 - V_1)$
10.	$V_o = -R_f C \frac{dV_{in}}{dt}$
11.	$V_o = -\frac{1}{R_{in}C} \int V_{in} dt$
12.	$T = 1.1 RC$
13.	$T_H = 0.693(R_A + R_B)C$
14.	$T_L = 0.693(R_B)C$
15.	$T = T_H + T_L$ $T = 0.693 (R_A + 2R_B)C$

BIL	LIST OF FORMULA
16.	$f = \frac{1}{T_H + T_L}$ $f = \frac{1.44}{(R_A + 2R_B)C}$
17.	$\%Duty\ Cycle = \frac{T_H}{T_H + T_L} \times 100$ $\%Duty\ Cycle = \frac{R_A + R_B}{R_A + 2R_B} \times 100$
18.	$X_C = R = \frac{1}{2\pi f_c C}$ $f_c = \frac{1}{2\pi RC}$ $A_{V\ dB} = 20 \text{ Log } \frac{V_o}{V_i}$
19.	$V_o = - \left[ \frac{R_F}{R} (V_1) + \frac{R_F}{2R} (V_2) + \frac{R_F}{4R} (V_3) + \dots + \frac{R_F}{2^{(N-1)R}} (V_N) \right]$
20.	$V_o = - \frac{V_{ref}}{2^n} \times B_{in} \times \frac{R_f}{R}$
21.	$Total\ steps = 2^n - 1$
22.	$\% \text{ resolution} = \frac{Step\ size}{Full\ scale} \times 100\%$ $\% \text{ Resolution} = \frac{1}{2^n - 1} \times 100\%$
23.	$T_C = Step\ size \times T$ $Conversion\ time = Number\ of\ steps \times T$