

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

DEE30043: ELECTRONIC CIRCUITS

TARIKH : 06 DISEMBER 2025

MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas soalan ini mengandungi **SEPULUH (10)** halaman bercetak.

Bahagian A: Subjektif (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 80 MARKS
BAHAGIAN A : 80 MARKAH

INSTRUCTION:

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

ARAHAN :

Bahagian ini mengandungi EMPAT (4) soalan subjektif. Jawab SEMUA soalan.

QUESTION 1

SOALAN 1

CLO1

- (a) A power supply typically has four basic sections that convert from AC into a DC supply. Describe the function of each section in a DC power supply block diagram, including the transformer, rectifier, filter, and voltage regulator.

Bekalan kuasa biasanya mempunyai empat bahagian asas yang menukar daripada AC kepada bekalan DC. Terangkan fungsi setiap bahagian dalam gambarajah blok bekalan kuasa DC, termasuk pengubah, penerus, penapis dan pengatur voltan.

[4 marks]

[4 markah]

CLO1

- (b) The oscillator acts as the main signal generator for multiple applications in electronic circuits. Explain the requirements for an oscillator circuit, supported by a block diagram of the oscillator.

Pengayun bertindak sebagai penjana isyarat utama untuk pelbagai aplikasi dalam litar elektronik. Terangkan keperluan untuk litar pengayun, disokong oleh gambarajah blok pengayun.

[6 marks]

[6 markah]

CLO1

- (c) A power supply is a device designed to deliver electrical energy to one or more electrical loads and also refers to devices that convert another form of energy (e.g: mechanical, chemical, solar) to electrical energy. With the aid of a schematic diagram, write the operation of a simple power supply which includes a center tap transformer, full-wave rectifier, π filter, and Zener diode voltage regulator circuits.

Bekalan kuasa ialah peranti yang direka untuk menghantar tenaga elektrik kepada satu atau lebih beban elektrik dan juga merujuk kepada peranti yang menukar bentuk tenaga lain (cth: mekanikal, kimia, suria) kepada tenaga elektrik. Dengan bantuan gambarajah skematik, tulis pengendalian bekalan kuasa ringkas yang merangkumi transformer Tap-Tengah, penerus gelombang penuh, penapis π dan litar pengatur voltan diod Zener.

[10 marks]

[10 marks]

QUESTION 2

SOALAN 2

CLO1

- (a) An oscillator is a device that can change DC voltage to AC voltage without any external resource at a certain level of frequency. List FOUR (4) types of LC oscillators.

Pengayun ialah peranti yang boleh menukar voltan DC kepada voltan AC tanpa sebarang sumber luaran pada tahap frekuensi tertentu. Senaraikan EMPAT (4) jenis pengayun LC.

[4 marks]

[4 markah]

CLO1

- (b) A Schmitt trigger is a type of comparator circuit that generates a square wave output waveform by converting an analog input signal into a digital signal as shown in Figure A2(b). It can be applied on several devices, such as the timer, operational amplifier, oscillator circuit, etc. Briefly explain the operating principle of Inverting Schmitt Trigger.

Pencetus Schmitt ialah sejenis litar pembanding yang menjana bentuk gelombang keluaran gelombang persegi dengan menukar isyarat input analog kepada isyarat digital seperti yang ditunjukkan dalam Rajah A2(b). Ia boleh digunakan pada beberapa peranti, seperti pemasa, penguat kendalian, litar pengayun, dll. Terangkan secara ringkas prinsip pengendalian Inverting Schmitt Trigger.

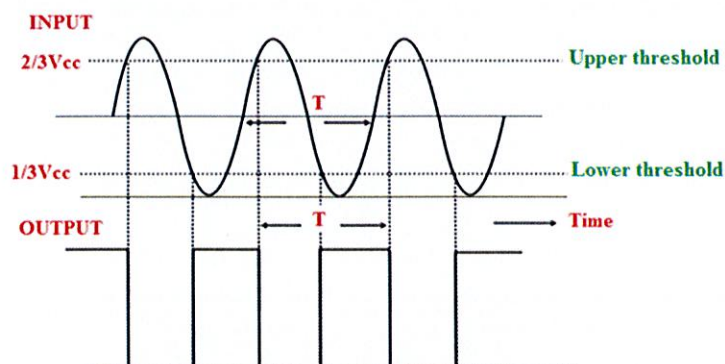


Figure A2 (b)/ Rajah A2 (b)

[6 marks]

[6 markah]

CLO1

(c) Based on Figure A2 (c), a Timer 555 is connected in Astable Mode. Calculate the Time High (TH), Time Low (TL), Frequency (f), and Duty Cycle (%).

Berdasarkan Rajah A2 (c), pemasa 555 disambungkan dalam Mod Astable. Kirakan Masa Tinggi (TH), Masa Rendah (TL), Frekuensi (f) dan Kitaran Tugas (%).

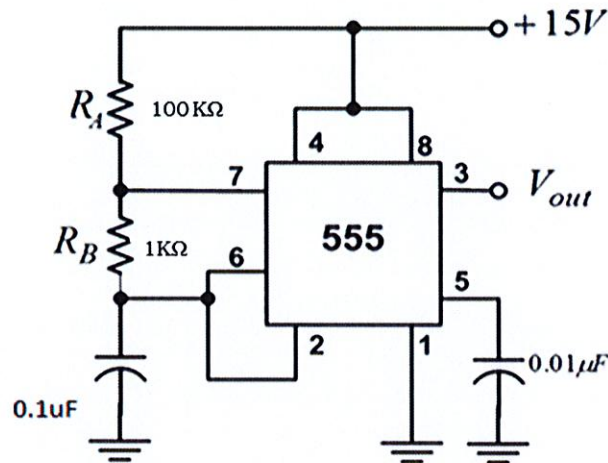


Figure A2 (c)/ Rajah A2 (c)

[10 marks]

[10 marks]

QUESTION 3**SOALAN 3**

CLO1

- (a) Generally, the frequency generator circuit for oscillators in the consumer product is divided into two. An oscillator that generates audio frequency and radio frequency. State **TWO (2)** differences between LC and RC types of oscillators.

*Secara amnya, litar penjana frekuensi untuk pengayun dalam produk pengguna dibahagikan kepada dua. Pengayun yang menjana frekuensi audio dan yang frekuensi radio. Nyatakan **DUA (2)** perbezaan antara pengayun jenis LC dan RC*

[4 marks]

[4 markah]

CLO1

- (b) Filters are categorized based on the frequencies that they are allowed to pass through. Essentially, an electrical filter is a circuit designed to modify, reshape, or eliminate unwanted frequencies in an electrical signal, allowing only the desired frequencies specified by the circuit designer to pass. Discuss the function of **THREE (3)** types of filters in electronic circuits.

*Penapis dikategorikan berdasarkan frekuensi yang dibenarkan untuk dilalui. Pada asasnya, penapis elektrik ialah litar yang direka untuk mengubah suai, membentuk semula atau menghalang frekuensi yang tidak diingini dalam isyarat elektrik, yang membenarkan hanya frekuensi yang dikehendaki yang ditentukan oleh pereka litar untuk melaluinya. Bincangkan fungsi **TIGA (3)** jenis penapis dalam litar elektronik.*

[6 marks]

[6 markah]

CLO1

- (c) Filters can be divided into two different types; active and passive filters. With the aid of a circuit diagram for Passive Band Pass Filter (BPF) consisting of $C1 = 0.1\mu F$, $C2 = 1000pF$, $R1 = 150\Omega$, and $R2 = 1.5k\Omega$, Calculate the higher cut-off frequency (F_H), lower cut-off frequency (F_L), and the bandwidth (BW) for this Filter.

Penapis boleh dibahagikan kepada dua jenis yang berbeza; penapis aktif dan pasif. Dengan bantuan gambarajah litar Penapis Lulus Lebar Pasif (BPF) yang terdiri daripada $C1 = 0.1\mu F$, $C2 = 1000pF$, $R1 = 150\Omega$, dan $R2 = 1.5k\Omega$, Kira frekuensi potong tinggi, frekuensi potong rendah dan lebar jalur (BW) untuk Penapis ini

[10 marks]

[10 marks]

QUESTION 4
SOALAN 4

CLO1

- (a) A Digital-to-Analog Converter (DAC) is an electronic device or circuit that converts digital data, usually in binary form, into an analog signal. List **TWO (2)** common types of DAC resistor networks in electronic circuits.

*Penukar Digital-ke-Analog (DAC) ialah peranti elektronik atau litar yang menukar data digital, biasanya dalam bentuk binari, kepada isyarat analog.. Senaraikan **DUA (2)** jenis rangkaian perintang DAC yang biasa dalam litar elektronik.*

[4 marks]

[4 markah]

CLO1

- (b) Digital to analog converter (DAC) is an electronic circuit that converts any digital signal into an analog signal. Compare **TWO (2)** differences between the R/2R ladder and binary-weighted converter.

*Penukar digital ke analog (DAC) ialah litar elektronik yang menukar sebarang isyarat digital kepada isyarat analog. Bandingkan (**DUA**) (**2**) perbezaan di antara penukar tangga R/2R dan perintang berwajaran binari.*

[6 marks]

[6 markah]

CLO1

- (c) The ladder arrangement consists of two types of resistors, R and $2R$. The circuit in Figure A4(c) refers to a 2 bit Digital to Analog Converter (DAC) based on an R - $2R$ ladder with a reference voltage of $5V$, $R_f=R=10k\Omega$. Calculate the analog output (V_o) if the input codes are 00, 01, 10, 11.

Susunan tangga terdiri daripada dua jenis perintang R dan $2R$. Litar dalam Rajah A4(c) merujuk kepada Penukar Digital ke Analog (DAC) 2 bit berdasarkan tangga R - $2R$ yang mempunyai voltan rujukan $5V$, $R_f=R=10k\Omega$. Kira keluaran analog (V_o) jika kod masukan ialah 00, 01, 10, 11.

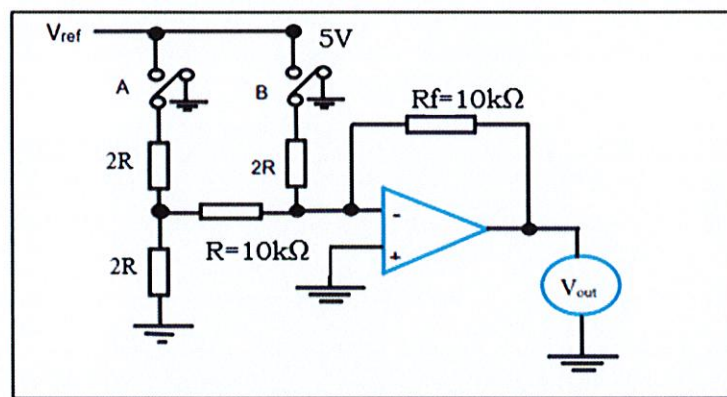


Figure A4(c)/ Rajah A4(c)

[10 marks]

[10 markah]

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

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

ARAHAN :

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

QUESTION 1**SOALAN 1**

CLO1

An Operational amplifier is one of the most commonly used devices in the application of analog circuits. Figure B1 shows one of the applications of an operational amplifier with an input voltage value, $V_{in} = 1V$, and output voltage, $V_{out} = 5V$. Refer to Figure B1 and the given value, write the amplifier's name, derive the close loop gain formula, calculate the voltage gain (A_v), the value of the R_f , and draw the input and output waveform.

Penguat kendalian ialah salah satu peranti yang paling biasa digunakan dalam aplikasi litar analog. Rajah B1 menunjukkan salah satu aplikasi penguat kendalian dengan nilai voltan masukan, $V_{in} = 1V$, dan voltan keluaran, $V_{out} = 5V$. Dengan merujuk Rajah B1 dan nilai yang diberi, tuliskan nama penguat, terbitkan formula bagi gandaan voltan litar tertutup, kirakan gandaan voltan (A_v), nilai R_f dan lukiskan bentuk gelombang input dan output.

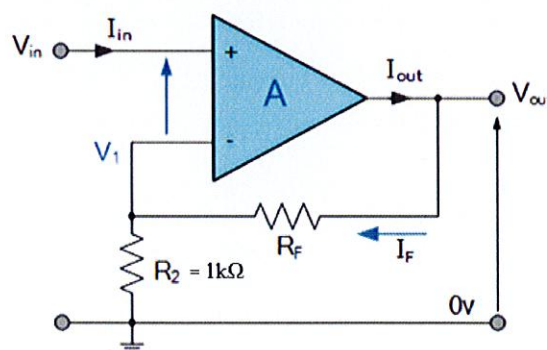


Figure B1 / Rajah B1

[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.	$X_C = R = \frac{1}{2\pi f_c C}$ $f_c = \frac{1}{2\pi RC}$ $A_{V\ dB} = 20 \log \frac{V_o}{V_i}$
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.	$\% resolution = \frac{Step\ size}{Full\ scale} \times 100\%$ $\% Resolution = \frac{1}{2^n - 1} \times 100\%$
23.	$T_C = Step\ size \times T$ $Conversion\ time = Number\ of\ steps \times T$

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