

SULIT



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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DEE20023: SEMICONDUCTOR DEVICES

TARIKH : 20 DISEMBER 2022

MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **ENAM (6)** halaman bercetak.

Bahagian A: Subjektif (4 soalan)

Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Tiada

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
C1 | (a) Define free electrons and holes.

<i>Takrifkan istilah <i>free electrons</i> and <i>holes</i>.</i>

<div style="text-align: right;">[4 marks]
[4 markah]</div> |
| CLO1
C2 | (b) With the aid of a diagram, explain forward biased and reverse biased voltage supply connection across P-N junction.

<i>Dengan bantuan gambarajah, terangkan voltan pincang hadapan dan pincang balikan merintangi simpang P-N.</i>

<div style="text-align: right;">[6 marks]
[6 markah]</div> |
| CLO1
C3, DP1,
DP3, DP4 | (c) A half wave rectifier operates with a silicon diode. Sketch the half wave rectifier circuit with input and output waveform.

<i>Penerus gelombang separuh beroperasi dengan satu diod. Lukiskan litar penerus gelombang separuh berserta gelombang masukan dan keluaran.</i>

<div style="text-align: right;">[10 marks]
[10 markah]</div> |

QUESTION 2**SOALAN 2**CLO1
C1

- (a) Label the schematic symbol of Bipolar Junction Transistor (BJT) for NPN and PNP type.

Labelkan simbol skematik Bipolar Junction Transistor (BJT) untuk jenis transistor NPN dan PNP.

[4 marks]

[4 markah]

CLO1
C2

- (b) With the aid of a diagram of diode I-V characteristics curve, explain forward current and reverse current.

Dengan bantuan gambarajah diod I-V berciri lengkung, terangkan ciri-ciri lengkung I-V bagi diod, terangkan arus pincang hadapan dan arus pincang songsang.

[6 marks]

[6 markah]

CLO1
C3, DP1,
DP3, DP4

- (c) The peak to peak voltage across the secondary winding for full wave center tap rectifier circuit is 210V. The load resistor, R_L is $4.7K\Omega$ and the diode resistance is neglected. Calculate output voltage (V_o), root means square voltage (V_{rms}), average voltage (V_{avg}) and average current (I_{avg}) for this rectifier.

Bekalan voltan puncak ke puncak merentasi gelung sekunder bagi litar penerus tap tengah gelombang penuh adalah 210V. Nilai rintangan beban R_L adalah $4.7K\Omega$ dan rintangan diod diabaikan. Kira voltan keluaran (V_o), voltan min punca kuasa (V_{rms}), voltan purata (V_{avg}) dan arus purata (I_{avg}) bagi litar penerus tersebut.

[10 marks]

[10 markah]

QUESTION 3

SOALAN 3

CLO1
C1

- (a) State
- FOUR (4)**
- applications of SCR in semiconductor devices.

*Nyatakan **EMPAT (4)** aplikasi SCR dalam peranti semikonduktor.*

[4 marks]

[4 markah]

CLO1
C2

- (b) Explain the principle operation region of n-channel JFET I-V characteristics.

Terangkan ciri- ciri prinsip operasi bahagian n-channel JFET I-V.

[6 marks]

[6 markah]

CLO1
C3, DP1,
DP3, DP4

- (c) Given
- $R_D = 2.2K\Omega$
- ,
- $R_G = 1M\Omega$
- ,
- $I_{DSS} = 10mA$
- ,
- $V_{DD} = 18V$
- and
- $V_p = -8V$
- . Calculate the
- V_{GS}
- ,
- I_{DS}
- ,
- V_{DS}
- ,
- V_D
- ,
- V_G
- and
- V_S
- of the circuit in Figure A3 (c).

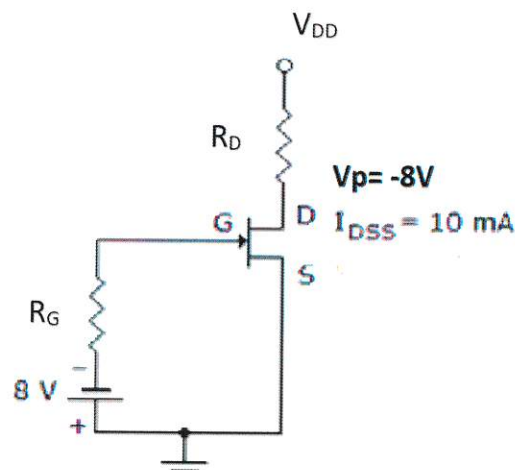
Diberi $R_D = 2.2K\Omega$, $R_G = 1M\Omega$, $I_{DSS} = 10mA$, $V_{DD} = 18V$ and $V_p = -8V$. Kirakan V_{GS} , I_{DS} , V_{DS} , V_D , V_G dan V_S untuk litar di dalam Rajah A3 (c).

Figure A3 (c) / Rajah A3 (c)

[10 marks]

[10 markah]

QUESTION 4**SOALAN 4**CLO1
C1

- (a) Give the physical structure and schematic symbol of TRIAC and DIAC.

Berikan struktur fizikal dan simbol skematik bagi TRIAC dan DIAC.

[4 marks]

[4 markah]

CLO1
C2

- (b) Silicon Controlled Rectifier (SCR) is a component with four-layers, three-junctions and a three-terminal device. Discuss how to turn on and turn off the Silicon Controlled Rectifier (SCR).

Silicon Controlled Rectifier (SCR) adalah komponen yang mempunyai empat lapisan, tiga simpang dan tiga terminal. Bincangkan bagaimana untuk menghidup dan mematikan Silicon Controlled Rectifier (SCR).

[6 marks]

[6 markah]

CLO1
C3, DP1,
DP3, DP4

- (c) A Bipolar Junction Transistor (BJT) is a three-terminal semiconductor device consisting of two p-n junctions. BJT has three terminals which are base, collector and the emitter. Demonstrate the basic operations of BJT.

Transistor Persimpangan Bipolar (BJT) adalah peranti semikonduktor tiga terminal yang mempunyai dua simpang p-n. BJT mempunyai tiga terminal iaitu tapak, pengumpul dan pengeluar. Tunjuk cara operasi asas BJT.

[10 marks]

[10 markah]

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

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**

CLO1
C3, DP1,
DP3, DP4

The DC Load Line of BJT Biasing Circuit is the line that represents all the DC operating points of the transistor. Q point is the operating point which determine the working point of a transistor. Figure B1 shows the Common Emitter configuration. Calculate I_B , I_{CQ} , V_{CQ} , $I_{C(sat)}$, and $V_{C(cut_off)}$. Given the value of $\beta = 60$ and $V_{BE} = 0.3V$. Draw the DC load line.

Garisan Beban AT Litar Bias BJT adalah garis yang mewakili semua titik operasi DC pada transistor. Titik Q ialah titik yang menentukan operasi transistor. Rajah B1 menunjukkan konfigurasi 'Common Emitter', Kirakan I_B , I_{CQ} , V_{CQ} , $I_{C(sat)}$ dan $V_{C(cut_off)}$. Diberikan nilai $\beta = 60$ dan $V_{BE} = 0.3V$. Lukis garis beban AT.

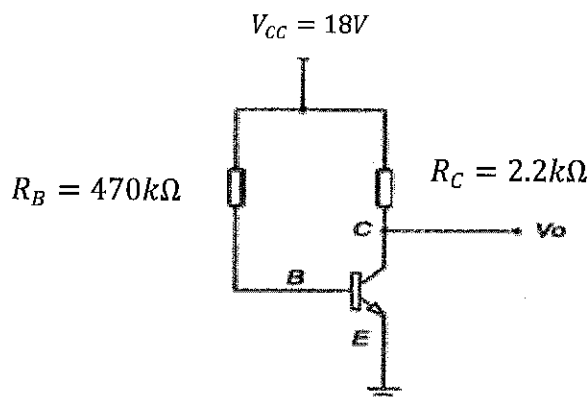


Figure B1/ Rajah B1

[20 marks]

[20 markah]

SOALAN TAMAT