UNIVERSITI MALAYSIA PERLIS

PEPERIKSAAN BUKU TERBUKA 2 (ATAS TALIAN)
Semester 2
Sidang Akademik 2021/2022

Mei 2022

NDJ10503 / DKT124 – Electronic Devices
[Peranti Elektronik]

Masa   : 1 jam 30 minit

Please make sure that this question paper has **FIVE (5)** printed pages including this front page before you start the examination.
*[Sila pastikan kertas soalan ini mengandungi **LIMA (5)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This paper has **TWO (2)** questions. Answer **ALL** questions. (40 Marks)
*[Kertas ini mengandungi **DUA (2)** soalan. Jawab **SEMUA** soalan. (40 Markah)]*

Question 1
[Soalan 1]

(a) An npn transistor is used to amplify the intensity of a light bulb and as a switch to control the states of the bulb. The transistor is biased with fixed-bias method. The light bulb is connected to the output of a Bipolar Junction Transistor (BJT) with the following parameters:
[Satu transistor digunakan untuk menguatkan keamatan satu mentol lampu dan sebagai suis untuk mengawal keadaan mentol tersebut. Transistor tersebut terpincang dengan kaedah terpincang-tetap. Mentol lampu disambungkan kepada keluaran sebuah transistor simpang dwikutub (BJT) dengan parameter-parameter berikut:]

Direct current (DC) voltage = 10 V
Bulb's resistance = Last four digits of your matric number in Ohm (Ω)
Base resistance = 250 kΩ
DC current gain, β_{DC} = 75
[Voltan arus terus (AT) = 10 V
Rintangan mentol = Empat angka terakhir nombor matrik dalam Ohm (Ω)
Rintangan tapak = 250 kΩ
Gandaan arus AT, β_{DC} = 75]

(i) Perform analysis if the transistor is operated in linear operation.
[Jalankan analisis jika transistor tersebut beroperasi dalam operasi lelurus.]

(6 Marks/*Markah*)

(ii) The transistor is then operated as a switch. Design a circuit if the transistor is used to switch on the light bulb. Your answer must include the condition for the transistor, calculations, and circuit showing the bulb as the output and current flows.
[Transistor tersebut kemudian digunakan sebagai suis. Rekabentuk satu litar jika transistor beroperasi untuk menghidupkan mentol lampu. Jawapan anda perlu disertakan dengan keadaan transistor, pengiraan dan litar yang menunjukkan mentol lampu sebagai keluaran dan aliran arus.]

(7 Marks/*Markah*)

(iii) llustrate the collector characteristic curve and direct current (DC) load line of the Bipolar Junction Transistor (BJT) showing all points involved in (i) and (ii).
*[Gambarkan lengkung ciri pengumpul dan garis beban arus terus (AT) bagi transistor simpang dwikutub (BJT) dengan menujukkan semua titik-titik yang terlibat dalam (i) dan (ii).]*

(7 Marks/*Markah*)

Question 2
[Soalan 2]

(a) Junction Field-effect Transistors (JFETs) are known as depletion mode devices. The depletion region formed in the channel of a JFET when voltage applied on one of its terminals (gate). **Figure 1** show depletion regions between the oppositely doped gate and channel sections. Re-draw the depletion regions for the following scenarios, where;
*[Transistor simpang kesan medan (JFET) dikenali sebagai peranti ragam susutan. Kawasan susutan terbentuk di dalam saluran JFET apabila voltan dikenakan pada salah satu terminalnya (pintu). **Rajah 1** menunjukkan kawasan-kawasan susutan bertentangan antara bahagian pintu dan saluran-saluran berdop. Lukis semula kawasan-kawasan susutan untuk senario berikut, di mana;]*
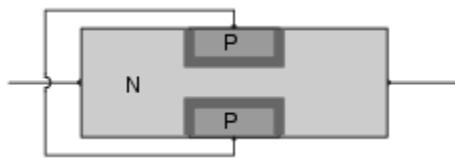
Figure 1
[Rajah 1]

(i) an external voltage, V_{GS} is applied positive between the gate and channel.
[voltan luaran, V_{GS} dikenakan positif antara pintu dan saluran.]

(2 Marks/ *Markah*)

(ii) an external voltage (V_{GS}) is applied negative between the gate and channel.
[voltan luaran, V_{GS} dikenakan negatif antara pintu dan saluran.]

(2 Marks/ *Markah*)

(iii) explain the working operation in (i) and (ii).
[terangkan operasi kerja dalam (i) dan (ii).]

(4 Marks/ *Markah*)

(b) **Figure 2** show a JFET voltage-divider bias with drain voltage, $V_D \cong 3$ V. Calculate:
*[**Rajah 2** menunjukkan pembahagi-voltan pincang JFET dengan voltan salir, $V_D \cong 3$ V. Kirakan:]*

(i) Gate voltage, V_G.
[Voltan pintu, V_G.]

(2 Marks/ *Markah*)

(ii) Drain current, I_D.
[Arus salir, I_D.]

(2 Marks/ *Markah*)

(iii) Source voltage, V_S.
[Voltan sumber, V_S.]

(2 Marks/ *Markah*)

(iv) Gate-to-source voltage,$V_{GS.}$
[Voltan pintu-ke-sumber,V_{GS}.]

(2 Marks/ *Markah*)
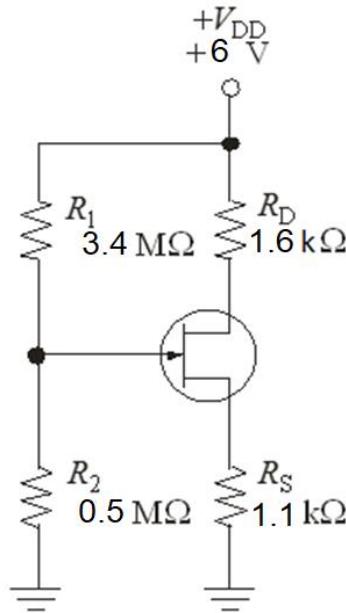
**Figure 2**
[Rajah 2]

(c) **Figure 3(a)** show self-biased JFET amplifier. The transistor parameters are $I_{DSS} = 8\ mA$ and $V_{GS(OFF)} = -6\ V$. The transfer characteristic curve is given in the **Figure 3(b).** Sketch a Direct Current (DC) load line and determine the Q-point of I_D and V_{GS}.
*[**Rajah 3(a)** menunjukkan penguat JFET pincang-diri. Parameter-parameter transistor ialah $I_{DSS} = 8\ mA$, dan $V_{GS(OFF)} = -6\ V$. Lengkung ciri pemindahan diberikan dalam **Rajah 3(b)**. Lakarkan garis beban arus terus (AT) dan tentukan titik-Q daripada I_D dan V_{GS}].*

(4 Marks/ *Markah*)
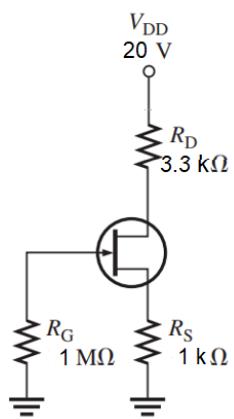
(a)
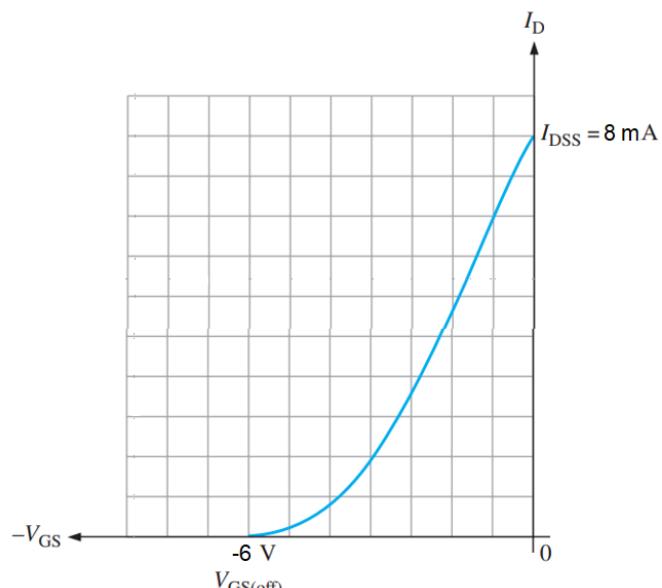
(b)

Figure 3
[Rajah 3]

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