

**JABATAN KEJURUTERAAN ELEKTRIK PUSAT
PENGAJIAN DIPLOMA (PPD), SPACE
UNIVERSITI TEKNOLOGI MALAYSIA KUALA
LUMPUR**

**DDWB/E/K 3711
(ELECTRONICS 2)**

**EXPERIMENT 2
FREQUENCY RESPONSE OF A COMMON-EMITTER
AMPLIFIER (BJT)**

EXPERIMENT 2 : FREQUENCY RESPONSE OF A COMMON-EMITTER AMPLIFIER (BJT)

OBJECTIVE

1. At the end of this experiment, students should be able to analyze the frequency response of a common-emitter amplifier circuit.

THEORY:

The analysis of the frequency response of an amplifier can be considered in three frequency ranges: the low-frequency, mid-frequency and high-frequency regions. The 3dB cutoff frequencies for the low-frequency region and the high-frequency region are defined at 70.7 % of the mid-frequency region (or $0.707 A_{vmid}$). Figure 1 shows the general form of the frequency response. The bandwidth (BW) of the frequency response's graph can be calculated using the following equation;

$$BW = f_H - f_L$$

In the low-frequency region, the capacitors used for DC isolation (AC coupling) and bypass

operation affect the lower cutoff (lower 3-dB) frequency. In the mid frequency range, only resistive elements affect the gain. Therefore the gain of the circuit remains constant. In the high-frequency region, stray wiring capacitances and device inter-terminal capacitances will determine the

circuit's upper cutoff frequency.

EQUIPMENTS

1. DC Power Supply
2. Function generator
3. Oscilloscope
4. Digital Multimeter or Analog Meter

Update: December 2012 (Othman Jais/ Zaimah Daud) Page 2

DDWE 3711 Electronics 2 Experiment 2 : Frequency Response of a Common-Emitter Amplifier (BJT)

COMPONENTS

1. BJT 2N3904
2. Resistors: 2.2 k Ω (2 units), 3.9 k Ω (1 unit), 10 k Ω (1 unit), and 39 k Ω (1 unit)
3. Capacitors: 1 μ F (1 unit), 10 μ F (2 units), 100 μ F (1 unit)

EXPERIMENT:

Procedure:

1. Connect the circuit as shown in Figure 1. Set the dc power supply, $V_{CC} = 20$ V.
2. Set the function generator to get the input signal, $V_{in} = 50$ mV_{p-p} and $f = 5$ kHz. 3. Observe the output voltage by using the oscilloscope. If V_o shows distortion, reduce the input signal, V_{in} until the output is undistorted. Record the value of V_{in} in the answer sheet.
4. Fix the value of V_{in} as in step 3. Vary the value of frequency as given in Table 1. Record the value of V_o for each frequency in Table 1.
5. Change the value of C_E to 100 μ F and repeat step 2 until 4. Complete Table 2.

$V_{CC} = 20$ V

R_C

3.9 k Ω R_1

39 k Ω

15 μ F

1 μ F

V_o

V_i

R_2 10 k Ω

R_E

2.2k Ω

Update: December 2012 (Othman Jais/ Zaimah Daud) Page 3

R_L 2.2k Ω

10 μ F

Figure 1

DDWE 3711 Electronics 2 Experiment 2 : Frequency Response of a
Common-Emitter Amplifier (BJT)

DDWE 3711 Electronics 2 Experiment 2 : Frequency Response of a
Common-Emitter Amplifier (BJT)

**JABATAN KEJURUTERAAN ELEKTRIK PUSAT
PENGAJIAN DIPLOMA (PPD), SPACE
UNIVERSITI TEKNOLOGI MALAYSIA KUALA
LUMPUR**

**DDWB/K/E 3711
(ELECTRONICS 2)**

**REPORT SHEET 2 FREQUENCY RESPONSE OF A
COMMON-EMITTER AMPLIFIER (BJT)**

Group members 1. 2. 3.

Lecturer : Date :

**No. PO CO Student Marks Marks 1 PLO1 CO1 40 2 PLO2 CO2
30 3 PLO4 20 4 PLO8 10**

Total Marks /100

EXPERIMENT 2 : FREQUENCY RESPONSE OF A COMMON EMITTER AMPLIFIER (BJT)

$C_E = 10 \mu\text{F}$ $V_{in(\text{peak})} = \dots\dots\dots \text{mV}$ $f = 5 \text{ kHz}$ **Frequency (Hz)** $V_{o(\text{peak})}$ (V) $A_v(\text{dB}) = 20 \log |V_{in}^o|$ Update: May 2018

(Othman Jais) Page 2 |

- 50
- 100
- 200
- 400
- 600
- 800
- 1 k
- 2 k
- 3 k
- 5 k
- 10 k
- 50 k
- 100 k
- 300 k
- 600 k
- 700 k
- 900 k
- 1 M

Table 1

PLO1 CLO1 /20m

$C_E = 100 \mu\text{F}$ $V_{in(\text{peak})} = \dots\dots\dots \text{mV}$ $f = 5 \text{ kHz}$ **Frequency (Hz)** $V_{o(\text{peak})}$ (V) $A_v(\text{dB}) = 20 \log |V_{in}^o|$ Update: May

2018 (Othman Jais) Page 3 |

- 50
- 100
- 200
- 400
- 600
- 800
- 1 k
- 2 k
- 3 k
- 5 k
- 10 k
- 50 k
- 100 k

300 k

600 k

700 k

900 k

1 M

Table 2

PLO1 CLO1 /20m

Questions:

1. From Table 1 and Table 2, plot and label the frequency response for BJT on a semi-log paper.

PLO1 CLO1 /20m

2. Determine the mid-band gain (A_{vmid}) and the 3-dB frequency points for each graph.

Complete Table 3.

$C_E = 10 \mu F$ $C_E = 100 \mu F$

A_{vmid}

f_L

f_H

B

W

Table 3

PLO1 CLO1 /5m 3. State the

relation between C_E and f_L .

.....

.....

.....

PLO1 CLO1 /5m 4. State the

relation between C_E and f_H .

.....
.....
.....

PLO1 CLO1 /5m 5. State the

relation between C_E and bandwidth of the graph.

.....
.....
.....

PLO1 CLO1 /5m

Update: May 2018 (Othman Jais) Page 4

DDWE 3711 Electronics 2 Report Sheet : Frequency Response of a Common Emitter Amplifier (BJT)

Conclusion;

.....
.....
.....
.....
.....
.....

PLO4 /10m

Update: May 2018 (Othman Jais) Page 5

DDWE 3711 Electronics 2 Report Sheet : Frequency Response of a Common Emitter Amplifier (BJT)

PLO2 (Psychomotor/Hands On Skills) for LABS Experiments

Very poor

Poor

Moderate

Good

Criteria

(5 Marks)

(10 Marks)

(15 Marks)

(20 Marks)

Update: May 2018 (Othman Jais) Page 6

**Excellent
(25 Marks)**

1

Can perform lab work moderately but require a lot of guidance
Can perform lab work systematically and only need minor guidance

Demonstrate **Ability to perform lab works**

systematic and **based on the manual/**

excellent **guidelines provided**

performances

2 Ability to perform simple lab

work without supervision

Not at all Quite Limited

/Selectively

Work independently With no supervision

3

Need full supervision Major supervision Minor

supervision

Limited supervision

Completed full circuit and it works successfully. However the measurement techniques/usage of equipment had some minor deficiency

Completed full circuit and it Not able to

works construct a full

successfully. circuit,

However the poor/inaccurate

measurement measurement

techniques/usage techniques/usag

ge of e of equipment

equipment had produced a few errors/corrections.

Circuit was completed and works properly without any errors /corrections. Also demonstrated an excellent skills/conducts.

4

Completed full **Ability to carry out lab work**

circuit but **efficiently on the following**

poor/inaccurate **criteria, (circuit assembly,**

measurement **using measurement apparatus**

techniques/usage **and techniques)**

of equipment

Demonstrates major errors in data collection and /or analysis. Limited ability in troubleshooting **Ability to**

collect the required data, performs appropriate analysis and/or troubleshooting (if necessary).

Minor error in data collection and analysis. Good approach/techniques in troubleshooting .

Data collection and data analysis are done systematically and performs excellent approaches to troubleshoot (if necessary) Not able to collect data and/or perform analysis

Limited data collection but not able to perform analysis/ troubleshooting

**PLO4 For Laboratory
Report**

**(5
Marks)**

nt

**Poo
r**

Criteria Very Poor

**(15
Marks)**

**Moderat
e
Moderat
e**

**(15
Marks)**

**(20
Marks)**

**Goo
d
Goo
d
Goo
d**

**(20
Marks)**

**(20
Marks)**

**Excele
nt
Excele
nt
Excele
nt
Excele**

**(25
Marks)**

**(25
Marks)**

**(25
Marks)**

**(25
Marks)**

missing significant pieces of information

(either table or graph).

Incomplete these of components of data (Both tables and Graphes):
Incomplete these of components of data (Both tables and Graphes):
Incomplete these of components of data (Both tables and Graphes):

Data is completed properly and attributes mentioned below are observed with great care:

Data is completed properly and attributes mentioned below are observed with great care:

Data is completed properly and attributes mentioned below are observed with great care:

Data is completed properly and attributes mentioned below are observed with great care:

Data is completed properly and attributes mentioned below are observed with great care:

- _____ Tables
- _____ Graphs

Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).
Only one component of data is incomplete (either table or graph).

- Tables are easy to read and units are provided.
- Tables are easy to read and units are provided.
- Tables are easy to read and units are provided.
- Tables are easy to read and units are provided.
- Graphs are labeled and shown trends.

Questions

without any depth and with many errors.

Questions are properly answered but with a few errors. Questions are properly answered but with a few errors. Questions are properly answered but with a few errors. Questions are properly answered but with a few errors. Questions are properly answered but with a few errors. Questions are properly answered but with a few errors.

Questions are answered completely and correctly. Questions are answered completely and correctly. Questions are answered completely and correctly. Questions are answered completely and correctly. Questions are answered completely and correctly. Questions are answered completely and correctly. Questions are answered completely and correctly.

Attempts were made but gave wrong answer to every question. Attempts were made but gave wrong answer to every question. Attempts were made but gave wrong answer to every question.

Questions are answered without any depth and with many errors. Questions are answered without any depth and with many errors. Questions are answered without any depth and with many errors. Questions are answered without any depth and with many errors. Questions are answered

3 Summary/Conclusion No conclusion

or summary
is/are
drawn/report
ed

/Summary
(mentioned) is
missing:

Any
component of
the conclusion

/Summary
(mentioned) is
missing:

Any
component of
the conclusion

/Summary
(mentioned) is
missing:

Any
component of
the conclusion

/Summary
(mentioned) is
missing:

- Summary
- Summary

Conclusio
n is too
brief
without
any
reference
to
important
pieces of
informatio
n

Any two
components of the
conclusion/summa
ry (mentioned) are
missing :

Any two
components of the
conclusion/summa
ry (mentioned) are
missing :

Any two
components of the
conclusion/summa
ry (mentioned) are
missing :

- Summary
- Data

Any
component of
the conclusion
/Summary
(mentioned) is
missing:
Any
component of
the conclusion

Conclusion /Summary
of these attributes
below were
addressed/reported
properly, clearly and
systematically.

Conclusion /Summary
of these attributes
below were
addressed/reported
properly, clearly and
systematically.

Conclusion /Summary
of these attributes
below were
addressed/reported
properly, clearly and
systematically.

Conclusion /Summary
of these attributes
below were
addressed/reported
properly, clearly and
systematically.

Conclusion / Summary of these attributes below were addressed/reported properly, clearly and systematically.

- experiment,
- experiment,
- experiment,
- data cited
- data cited
- data cited

- Data
- Hypothesis

- hypothesis/assumptions made
- hypothesis/assumptions made
- hypothesis/assumptions made
- hypothesis/assumptions made
- The source of errors.

Report is good but with few spelling or grammatical errors.

Report is good but with few spelling or grammatical errors.

Report is good but with few spelling or grammatical errors.

- Hypothesis
- Errors

Report is well written and cohesive, with a few errors

Report is well written and cohesive, with a few errors

Report is well written and cohesive, with a few errors

Report is well written and cohesive, with a few errors

Report is well written and cohesive, with a few errors

Report is very well written without any spelling or grammatical mistakes.

Report is very well written without any spelling or grammatical mistakes.

Report is very well written without any spelling or grammatical mistakes.

Report is very well written without any

4 Report Quality No attention to detail evident.

Report contains many errors.

spelling or
grammatical
mistakes.
Report is very well

written without any
spelling or
grammatical
mistakes.

DDWE 3711 Electronics 2 Report Sheet : Frequency Response of a Common Emitter Amplifier (BJT)

PLO8 for LABS Experiments

Criteria -Understand the conducts, ethical values and socio-

Very poor

Poor

Moderate

cultural impacts on professional norm and

(5 Marks)

(10 Marks)

(15 Marks)

practice

Update: May 2018 (Othman Jais) Page 8

Good

(20 Marks)

Excellent

(25 Marks)

1

Not always Conforming/ Not always punctual

Sometimes Conforming/ Sometimes punctual

Always Conforming /Always Punctual

2

Professional Practice

Non- (Punctuality/Follow the Rules)

Conforming/In-

Conforming /Punctual

punctuality

Ethical Conduct/Behaviour (Trustworthy / Respectfulness)

Does not practice

Not always practicing

Sometimes only

Mostly practicing

Always practicing

3

Always observe

4

Social Cultural (Racial Harmony) Does not

observe

Not always observe

Sometimes observe

Mostly observe

Personality Mostly

unpleasant

Not always pleasant

Moderately pleasant
Mostly pleasant
Always pleasant