EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

ELECTRICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSION

EE201 : SEMICONDUCTOR DEVICES

DATE : 20 NOVEMBER 2012 (TUESDAY)
DURATION : 2 HOURS (8:30 AM TO 10.30 AM)

This paper consists of TEN (10) pages including the front page.
Section A1 : Objective (10 Question)
Section A2 : Fill in the blank (10 Question)
Section B : Structured (10 Question)
Section C : Essay (2 Question)

Answer all questions

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BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only.)
OBJECTIVE

Instructions: This section consists of 20 objective questions. Answer all questions in the answers booklet.

1. Which of the following statements explain the term a semiconductor? [CLO1]
   A. Valence electron are weakly attracted to the nucleus of the atoms
   B. Material that behaves in between a conductor and insulator.
   C. The substance that resist the flow of electric current.
   D. High amount of free mobility electrons.

2. Which of the following statements is NOT the diode application in an electronic circuit? [CLO1]
   A. Diode as Clipper.
   B. Diode as Rectifier.
   C. Diode as Amplifier.
   D. Diode as Clamper

3. A full-wave bridge rectifier consists of [CLO2]
   A. 1 Diode
   B. 2 Diodes
   C. 3 Diodes
   D. 4 Diodes
4. RC coupling configuration is a part of multistage amplifier, when the output of the first stage is

A. Coupled to the input of the next stage through the capacitor and resistive
B. Coupled to the input of the next stage through an impedance matching transformer
C. Directly connected to input of the next stage
D. Coupled to the input of the next stage through the inductor

5. Which of the statement below describe the operation of direct coupling circuit?

i. There is a direct connection between the collector of the first transistor and the base of the second transistor
ii. The coupling capacitor transmits the amplified ac voltage to the next stage
iii. The ac voltage is coupled through a transformer to the next stage.

A. i
B. i and ii
C. ii and iii
D. i, ii, and iii

6. The transistor operating in cut off and saturation region acts like

A. Switch
B. Linear amplifier
C. Variable resistor
D. Variable capacitor
7. Given \( I_B = 125 \mu A \) and \( \beta = 200 \), the collector current will be [CLO 2]

A. 25\( \mu A \)  
B. 25mA  
C. 0.0025\( \mu A \)  
D. 0.025mA

8. N-Channel FETs are superior to P-Channel FETs because [CLO1]

A. They have higher input impedance  
B. They have high switching time  
C. They consume less power  
D. Mobility of electrons is greater than that of holes

9. The supply voltage that is connected directly or indirectly to the drain of a FET is presented by [CLO1]

A. \( V_{GS} \)  
B. \( V_{DS} \)  
C. \( V_{SS} \)  
D. \( V_{DD} \)

10. Below are the THREE (3) applications for Unijunction Transistor (UJT) EXCEPT [CLO1]

A. timer circuit  
B. phase control  
C. voltage regulator  
D. signal generator circuit
11. The minority carriers in P-type silicon are called __________.  

12. Testing a good diode with an ohmmeter should indicate  
   __________ resistance when reverse biased and __________  
   resistance when forward biased.  

13. When the polarity of the battery is such that electrons are allowed to  
    flow through the diode, the diode is said to be ______________.  

14. Cascaded Amplifier is a ________ connection of two or more amplifiers.  
    The basic purpose of a Cascaded Amplifier is to ________  
    the voltage gain.  

15. The most commonly used coupling in an amplifier is ______________.  

16. Common Collector configuration shows that ____________  
    terminal will be connected to ground.  

17. Beside used as an amplifier, BJT also used as a _________.  

18. An E-MOSFET works only with ____________ gate voltages.  

19. Refer to Figure 1 below. The I-V curve belongs to ____________  [CLO 1]

![Figure 1](image)

20. In an SCR, the function of the gate is to _________________.  [CLO2]
SECTION B

STRUCTURED (30 marks)
Instruction: This section consists of 10 structured questions. Answer ALL questions

QUESTION 1
Give THREE (3) factors which enable electron to be free from the covalent bond. [CLO2] (3 marks)

QUESTION 2
Draw the symbol of LED and give the example of its application. [CLO2] (3 marks)

QUESTION 3
If p-type material is connected to the negative terminal of the power supply, what will happen to:- [CLO2]

   i. Depletion region (1 mark)
   ii. Resistance (1 mark)
   iii. Current flow (1 mark)

QUESTION 4
Draw and label the block diagram of Multistage Amplifier. [CLO 1] (3 marks)

QUESTION 5
State the differences between negative and positive feedback in an amplifier. [CLO 1] (3 marks)

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QUESTION 6
Draw the schematic diagram of a diode clipper and clamper circuits.  
[CLO1]  
(3 marks)

QUESTION 7
Give THREE disadvantages of MOSFET.  
[CLO1]  
(3 marks)

QUESTION 8
Draw and label the symbol of MOSFET below:  
[CLO2]  
(3 marks)

a. N-channel enhancement MOSFET  
b. N-channel depletion MOSFET

QUESTION 9
Draw and label the schematic symbols for DIAC.  
[CLO2]  
(3 marks)

QUESTION 10
Name the terminal numbered 1,2,3 for Unijunction Transistor (UJT) below.  
[CLO2]  
(3 marks)

1. ..........................  
2. ..........................  
3. ..........................

Figure 2
SECTION C

ESSAY (50 marks)

INSTRUCTION:

This section consists of TWO (2) essays questions.
Answer all the questions.

QUESTION 1

Based on the Figure 3, answer the following questions.

Value given for $V_{GH} = 20V_{p-p}, 50Hz$

![Figure 3](image)

a. Draw the waveform at point G-H. [CLO2] (4 marks)

b. Draw the waveform at point A-B. [CLO 2] (4 marks)

c. Determine the value of $V_{out}$. [CLO 2] (5 marks)

d. Explain how the diodes in circuit diagram operate. [CLO 2] (12 marks)
**QUESTION 2**

a. State the TWO (2) configurations of BJT and draw the connections.  

[CLO 2]  
(3 marks)

b. With reference to Figure 4, calculate the value of

i) $I_B$  

ii) $I_C$  

iii) $V_{RC}$  

iv) $V_{CQ}$  

[CLO 2]  
(3 Marks)

v) Saturation Point  

vi) Cut-off point  

(3 Marks)

c. Draw the DC Load Line for Figure 4.  

[CLO 2]  
(4 Marks)