UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	: LED 10302
COURSE NAME	: INTRODUCTION TO ELECTRONICS
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: DIPLOMA OF ENGINEERING TECHNOLOGY IN ELECTRICAL AND ELECTRONICS (MARINE)
DATE	: 26 MAY 2016
TIME	: 08.00 AM – 10.00 AM
DURATION	: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer ONLY THREE (3) questions only.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 11 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 25 marks)

INSTRUCTION: Answer ALL questions.
Please use the objective answer sheet provided.

1. In a semiconductor, the concept of an energy gap is used to show difference between the energies of the:
   A. Nucleus and outer shell electrons
   B. Nucleus and the free electrons
   C. Conduction band electrons and valence electrons
   D. Core electrons and valence electrons

2. By using the practical diode model, determine the current flow in the circuit shown in Figure 1.

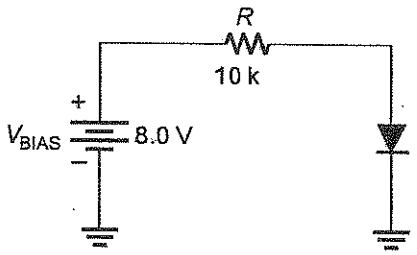

Figure 1

   A. 0.73 mA
   B. 0.80 mA
   C. 0.87 mA
   D. 1.2 mA

3. Identify the circuit shown in Figure 2.

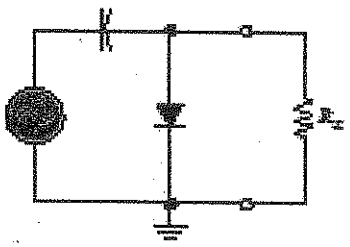

Figure 2

   A. Negative clipping circuit
   B. Positive clipping circuit
   C. Negative clamping circuit
   D. Positive clamping circuit

4. Describe the function of the circuit shown in Figure 2.

A. Removes all the negative parts of the input signal.

B. Shift a signal negatively by adding a dc voltage to the signal.

C. Shift a signal positively by adding a dc voltage to the signal.

D. Removes all the positive parts of the input signal.

5. Name the circuit shown in Figure 3.

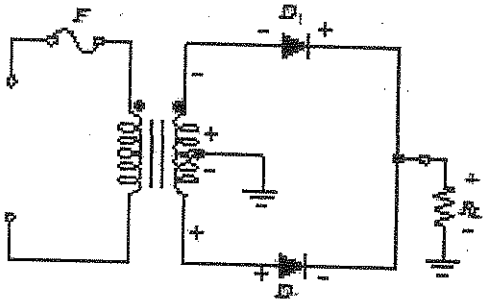

Figure 3

A. Half-wave rectifier

B. Full-wave rectifier

C. Bridge rectifier

D. Voltage double

6. Determine the PIV for the circuit shown in Figure 3.

A. $V_{p(sec)}/2$

B. $V_{p(sec)}$

C. $2\,V_{p(sec)}$

D. $V_{p(sec)} / \sqrt{2}$

7. What is the value of positive output will be limited, if each zener diodes has a zener voltage of 5.0 V as shown in Figure 4?

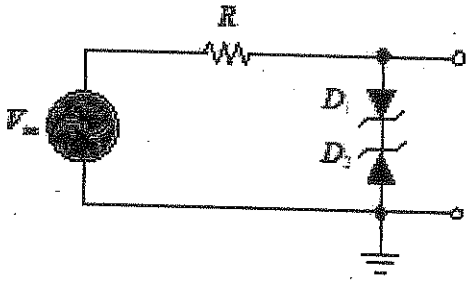

Figure 4

A. +1.4 V

B. +10 V

C. +4.3 V

D. +5.7 V

8. Identify type of bias is required for normal operation of zener diode.

A. Reverse
B. Forward
C. Positive
D. Negative

9. A varactor is a diode used as a voltage-controlled of:

A. Capacitor
B. Current sensor
C. Light sensor
D. Resistor

10. Identify the circuit inside electronics equipment that converts the ac input voltage to an almost perfect DC output voltage

A. Modulator
B. Capacitor
C. Filter
D. Transformer

11. Identify type of diode that with a negative resistance region in its characteristic curve.

A. Photodiode
B. Varactor
C. Tunnel diode
D. Schottky diode

12. Determine the display device that contains seven rectangular LEDs curve.

A. CRT
B. Laser
C. Light emitting diode
D. 7-segment display

13. A half-wave rectifier uses _____ diode in the circuit.

A. 1
B. 2
C. 3
D. 4

14. A _____ diodes maintains a constant voltage across it when operating in the breakdown region.

A. Germanium
B. Zener
C. Silicon
D. None of the above

15. If input frequency is 50 Hz, the output frequency of a bridge rectifier is

A. 50 Hz
B. 100 Hz
C. 25 Hz
D. 150 Hz

16. A Bipolar Junction Transistor (BJT) is _____.
    A. Voltage controlled device
    B. Current controlled device
    C. Both A and B
    D. Either A and B

17. Identify the region of a transistor is very lightly doped and very thin.
    A. Collector
    B. Drain
    C. Base
    D. Emitter

18. A β_{DC} is defined as _____.
    A. Emitter current to collector current
    B. Emitter current to base current
    C. Collector current to emitter current
    D. Collector current to base current

19. Normal operation of an PNP BJT requires the base to be _____ with respect to the emitter, and _____ with respect to the collector
    A. Positive, negative
    B. Negative, negative
    C. Negative, positive
    D. Positive, positive

20. Name the three terminal of JFET.
    A. Drain, gate, collector
    B. Drain, gate, source
    C. Collector, emitter, base
    D. Drain, gate, base

21. A JFETs cannot be biased using _____.
    A. Zero bias
    B. Voltage-divider bias
    C. Current-source bias
    D. Self-bias

22. A _____ is type of FET that can be used the same bias method as a BJT.

A. JFET
B. D-MOSFET
C. E-MOSFET
D. All of the above

23. The 2's complement of a 1000 is _____.

A. 0111
B. 1010
C. 1001
D. 1000

24. A 2-input gate produces a HIGH output only when the inputs agree. Identify the type of this gate.

A. XNOR gate
B. AND gate
C. Inverter
D. NOR gate

25. A Boolean expression that is in standard SOP form is _____.

A. The minimum logic expression
B. Has every variable in the domain in every term
C. Contains only one product term
D. None of the above

SECTION B (Total: 75 marks)

INSTRUCTION: Answer only THREE (3) questions.
Please use the answer booklet provided.

Question 1

(a) In the isolated atomic structure there are discrete energy band associated with each orbiting electron. Each material will have its own permissible energy band for the electrons in its atomic structure. Explain the difference between conductor, semiconductor and insulator.

(10 marks)

(b) Describe how the N-type semiconductor material is formed.

(5 marks)

(c) Explain the formation of Depletion Region with appropriate diagram

(10 marks)

Question 2

(a) State the function of zener diode and draw its symbol

(2 marks)

(b) Determine the range of values of V_i that will maintain zener diode in Figure 2.1 in **'ON'** state

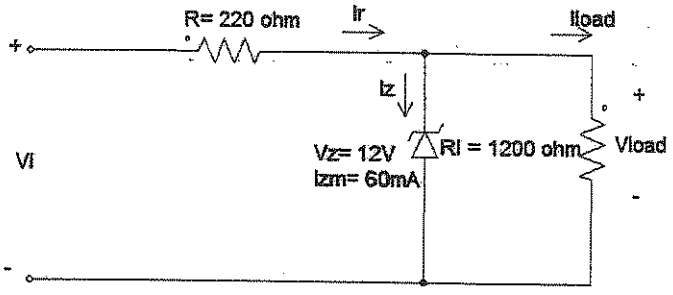

Figure 2.1

(8 marks)

(c) Consider the full-wave rectifier circuit in Figure 2.2, the load resistance is R_{load} = 125Ω, each diode voltage is V_D= 0.7 V and the frequency of the input signal is 60 Hz. The magnitude of the peak output voltage is to be 15V.

i. Sketch the input and output voltage waveforms of the circuit shown in Figure 2.2

(4 marks)

ii. Determine the rms value of V_S.

(9 marks)

iii. Determine the output current in the 125 Ω load resistance.

(2 marks)

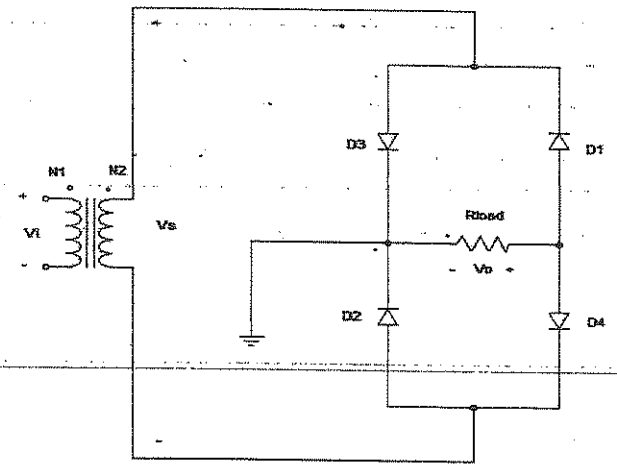

Figure 2.2

Question 3

(a) Identify two (2) types of BJTs according to their structure.

(4 marks)

(b) For the circuit shown in Figure 3.1, the parameters given are; V_{BB} = 4V, R_B = 220 kΩ, R_C = 2kΩ, V_{CC}= 10V, $V_{BE(ON)}$ = 0.7V and β= 200. Calculate:

i. Base current (I_B).

(4 marks)

ii. Collector current (I_C)

(2 marks)

iii. Emitter current (I_E)

(2 marks)

iv. Base voltage (V_B)

(3 marks)

v. Collector voltage (V_C).

(3 marks)

vi. Emitter voltage (V_E)

(3 marks)

vii. Common-emitter voltage (V_{CE})

(4 marks)

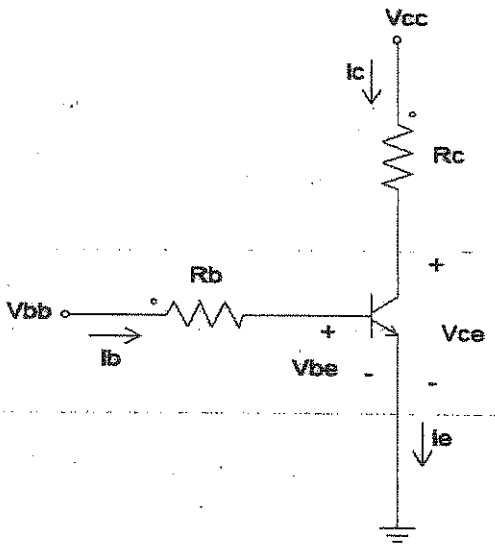

Figure 3.1

Question 4

(a) State the three (3) terminal of Junction Field Effect Transistor (JFET)

(3 marks)

(b) Analyze the circuit shown in Figure 4.1 below. The drain current, I_D is approximately, 2.6 mA. For the circuit shown in Figure 4.1, the parameters given are: V_{DD} = 20V, V_G= 0 V, R_D = 3.3 kΩ, R_G = 1MΩ and R_S = 1kΩ

Calculate the following:

i. V_{DS}

(3 marks)

ii. V_S

(3 marks)

iii. V_G

(1 marks)

iv. V_{GS}

(3 marks)

v. V_D

(3 marks)

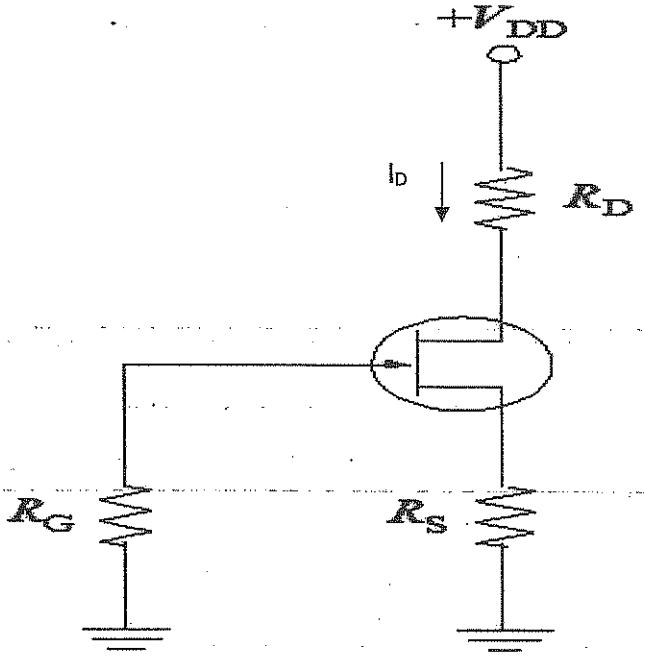

Figure 4.1

(c) i. Develop the truth table for a NAND gate.

(2 marks)

ii. Sketch the symbol for a NAND gate.

(2 marks)

iii. Refer to the circuit shown in Figure 4.2 below, state the Boolean Expression for output, Y5 of the circuit.

(5 marks)

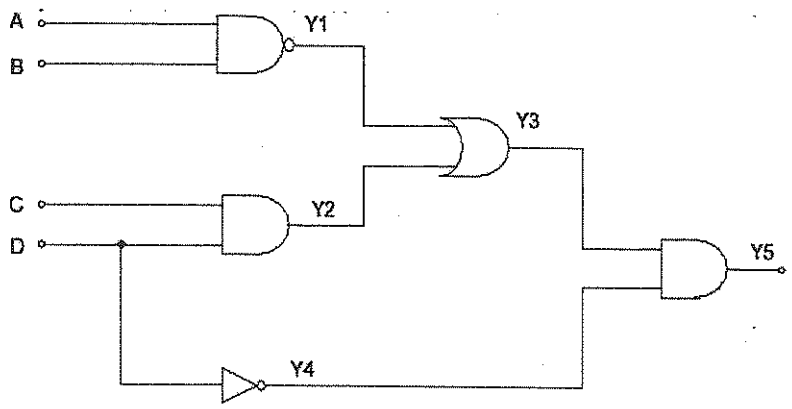

Figure 4.2

END OF EXAMINATION PAPER