



**KENYA MEDICAL TRAINING COLLEGE
FACULTY OF REHABILITATIVE SCIENCES
DEPARTMENT OF MEDICAL ENGINEERING**

**FINAL QUALIFYING EXAMINATION
FOR
CERTIFICATE IN MEDICAL ENGINEERING TECHNOLOGY
PAPER: ELECTRONICS**

DATE: 15th June 2022

TIME: 3 HOURS (9:00AM – 12:00 PM)

INSTRUCTIONS

1. This paper consists of:
 - Section 1 (40 Multiple Choice Questions)
 - Section 2 (8 Short Answer Questions)
 - Section 3 (1 Long Answer Question)
2. Attempt **ALL** Questions
3. Write the **EXAMINATION NUMBER** given on all the answer sheets provided and on the question paper.
4. Ensure that all examination answer scripts are handed in at the end of the examination
5. Ensure you sign the examination register provided

EXAMINATION NUMBER

ELECTRONICS

SECTION 1: MULTIPLE CHOICE QUESTIONS (40 MARKS)

1. Number of valence electrons in a silicon atom are?
 - a) 1
 - b) 4
 - c) 8
 - d) 16
2. The most commonly used semi-conductor element is?
 - a) Silicon
 - b) Germanium
 - c) Gallium
 - d) Carbon
3. The valence electrons of a conductor also called?
 - a) Bound electrons
 - b) Free electrons
 - c) Nucleus
 - d) Proton
4. An intrinsic semi-conductor at room temperature has?
 - a) A few electrons and holes
 - b) Many holes
 - c) Many free electrons
 - d) No holes
5. At room temperature, an intrinsic semiconductor has some holes in it due to?
 - a) Doping
 - b) Free electrons
 - c) Thermal energy
 - d) Valence electrons
6. Electrons are the minority carrier's in
 - a) Extrinsic semiconductors
 - b) P-type semiconductors
 - c) Intrinsic semiconductors
 - d) N-type semiconductors
7. In a semi-conductor diode, depletion layer is caused by
 - a) Doping
 - b) Recombination
 - c) Barrier potential
 - d) Ions
8. Avalanche in a diode occurs at
 - a) Barrier potential
 - b) Depletion layer
 - c) Knee voltage
 - d) Break down voltage

9. The potential barrier at a silicon diode is
- a) 0.3V
 - b) 0.7V
 - c) 1V
 - d) 5V
10. A diode is a
- a) Bilateral device
 - b) Non-linear device
 - c) Linear device
 - d) Unipolar device
11. The output voltage signal of a bridge rectifier is
- a) Half wave
 - b) Full-wave
 - c) Bridge rectified signal
 - d) Sine wave
12. A zener diode can be described as
- a) Rectified diode
 - b) A device with constant voltage
 - c) A device with constant current
 - d) A device that works in the forward system
13. If the zener diode is connected in wrong polarity the voltage across the load is
- a) 0.7V
 - b) 10V
 - c) 14V
 - d) 18V
14. The number of PN junctions in a transistor is
- a) One
 - b) Two
 - c) Three
 - d) Four
15. The doping concentration of Base in NPN transistor is
- a) Light doped
 - b) Moderately doped
 - c) Heavily doped
 - d) Not doped
16. The Base –emitter junction in an NPN transistor
- a) Does not conduct
 - b) Is forward biased
 - c) Is reverse biased
 - d) Operates in breakdown region

17. The size comparison between Base, Emitter and Collector is
- Base > Collector > emitter
 - Emitter > Collector > Base
 - Collector > Emitter > Base
 - All are equal
18. The D.C current gain in the common emitter configuration of a transistor is
- Ratio of emitter current to collector current
 - Ratio of base current to emitter current
 - Ratio of collector current to base current
 - Ratio of base current to collector current
19. If base current is $100\mu A$ and current gain is 100, then collector current is
- 1A
 - 10A
 - 1mA
 - 10mA
20. A transistor acts as a
- Voltage source and resistor
 - Diode and current source
 - Voltage source and current source
 - Diode and power supply
21. The relation between base current I_B , Emitter current I_E and collector current I_C is
- $I_E = I_B + I_C$
 - $I_B = I_C + I_E$
 - $I_E = I_B - I_C$
 - $I_C = I_B + I_E$
22. The total power dissipated by a transistor is a product of collector current and
- Supply voltage
 - 0.7V
 - Collector-Emitter Voltage
 - Base- Emitter Voltage
23. The relation between α and β is
- $\alpha = \beta / (\beta + 1)$
 - $\beta = \frac{\alpha}{\alpha + 1}$
 - $\alpha = \beta(\beta + 1)$
 - $\alpha = \beta / (\beta - 1)$
24. A silicon controlled rectifier (SCR) is
- Injunction device
 - Device with three junction
 - Device with four junction
 - None of the above

25. A thyristor is basically
- a) PNPN device
 - b) A combination of diac and triac
 - c) A set of SCRs
 - d) A set of SCR diac and triac
26. Which of the following semiconductor power devices below is not a current triggered device?
- a) Thyristor
 - b) Triac
 - c) C.T.O
 - d) MOSFET
27. Which of the following devices does not exhibit negative resistance characteristic?
- a) FET
 - b) UJT
 - c) Tunnel diode
 - d) SCR
28. A thyristor is turned off when the anode current falls below
- a) Forward current
 - b) Latching current
 - c) Holding current
 - d) Breakover current
29. In a thyristor circuit, the angle of conduction is changed by changing
- a) Anode current
 - b) Gate current
 - c) Forward current
 - d) Anode current
30. The VI characteristics of UJT is
- a) Similar to CE with linear and saturation region
 - b) Similar to FET with linear and pinchoff region
 - c) Similar to tunnel diode in some respects
 - d) Similar to PN junction diode in some respect
31. A thermocouple is a _____ type of transducer
- a) Variable resistance
 - b) Variable inductance
 - c) Voltage generating
 - d) Voltage divider
32. Self, generating type of transducers are _____ transducers
- a) Active
 - b) Passive
 - c) Secondary
 - d) Inverse

33. The transducer that convert the input signal into the output signal, which is a discrete function of time is known as _____
- a) Active
 - b) Analogue
 - c) Digital
 - d) Pulse
34. Quartz crystal is most commonly used in crystal oscillators because
- a) It has superior electrical properties
 - b) It is easily available
 - c) It is quite inexpensive
 - d) None of the above
35. An oscillator produces _____ oscillations
- a) Damped
 - b) Undammed
 - c) Modulated
 - d) None of the above
36. A multivibrator is an electronic is used to implement
- a) Oscillator
 - b) Timer
 - c) Flip-flop
 - d) All of the above
37. Astable multivibrator is _____ in any state.
- a) Stable
 - b) unstable
 - c) saturated
 - d) both staple and saturated
38. In which of the following base systems is 123 not a valid number
- a) base 10
 - b) base 16
 - c) base 8
 - d) base 2
39. The universal gate is
- a) NAND gate
 - b) OR gate
 - c) AND gate
 - d) None of the above
40. The inverter is
- a) NOT gate
 - b) OR gate
 - c) AND gate
 - d) None of the above

SECTION 2: SHORT ANSWER QUESTIONS (40 MARKS)

41. State five advantages of using a transistor as a switch. (5 marks)
42. a) Name and sketch any two types of transistor circuit configuration. (4 marks)
- b) State the most commonly used configuration. (1 mark)
43. Define the following terms with reference to transistor amplifiers;
- i. Bandwidth
 - ii. Feedback
 - iii. Gain
 - iv. Distortion
 - v. Gain Bandwidth product (GBW) (5 marks)
- 44.i) Differentiate between zener breakdown and avalanche breakdown across a PN junction diode. (3 marks)
- ii) State two main applications of zener diodes in electronics. (2 marks)
45. List out the characteristics of an ideal operational amplifier. (5 marks)
46. Compare and contrast differences between MOSFET and BJT. (5 marks)
47. a) Define the following terms:
- i. Multivibrator (1 mark)
 - ii. Oscillator (1 mark)
- b) List three classes of multivibrators. (3 marks)
48. Draw an EXOR and show the truth table. (5 marks)

SECTION 3: LONG ANSWER QUESTIONS (20 MARKS)

- 49.
- i. What is the difference between positive and negative feedback? (2 marks)
 - ii. List two advantages of positive feedback. (2 marks)
 - iii. An oscillator employs _____ feedback. (1 mark)
 - iv. With the aid of labelled diagrams, explain the difference between damped and undamped oscillations. (5 marks)
 - v. Using a suitable diagram describe the principle of operation of a UJT relaxation oscillator. (10marks)