METAL OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTORS (MOSFETS) AND COMMON ELECTRONIC CIRCUITS

1. What percentage of today's electronic circuits uses MOSFETs?
   a. 75%
   b. 80%
   c. 90%
   d. 100%

2. Heterojunction bipolar transistors (HBT's) are the
   a. Fastest devices made
   b. Only used in older equipment
   c. Simplest devices made
   d. Smallest devices made

3. How many MOSFETs can be put in the same physical area as a single BJT?
   a. 25
   b. 50
   c. 100
   d. 200

4. List three reasons why MOSFETs are favored over BJTs.

5. Because of their smaller size, MOSFET circuits have been able to reach frequencies as high as
   a. 1 GHz
   b. 1 MHz
   c. 1 THz
   d. 100 MHz

6. The lower power required by MOSFETs has led to an increase in
   a. Battery size
   b. Physical size
   c. Portable devices
   d. Stationary devices

7. The input impedance of a MOSFET gate is:
   a. Relatively low (ohms)
   b. Mid range (K ohms)
   c. Relatively high (M ohms)
   d. Can vary across all ranges

8. Since a MOSFET gate draws almost no current, the device
   a. Moderately "loads" the driving circuit
   b. Does not "load" the driving circuit
   c. Heavily "loads" the driving circuit
   d. Needs it's own driving circuit

9. The input impedance to a MOSFET is seen as
   a. A capacitor
   b. An inductor
   c. A large resistor
   d. Unimportant

10. MOSFET circuits can be constructed without resistors.
    a. True
    b. False

11. What is the main disadvantage of a MOSFET??

12. The only area in which BJT's outperform MOSFETs is in
    a. Digital applications
    b. High frequency applications (>10GHz)
    c. Microprocessors
    d. Wireless applications

13. The feature size of most current MOSFETs is as low as
    a. 0.5 micron
    b. 0.25 micron
    c. 0.13 micron
    d. 0.01 micron

14. Which type of MOSFET is the most widely used?
    a. Depletion mode
    b. Enhancement mode
    c. N type
    d. P type

15. In an N channel MOSFET, the source and drain are both N type material.
    a. True
    b. False

16. In an N channel MOSFET, a thin layer of _____ is placed between the substrate and the gate.
    a. Metal
    b. N type silicon
    c. P type silicon
    d. SiO_2

17. The gate of a MOSFET is made of a/an
    a. Highly conductive material
    b. Insulating material
    c. Semiconducting material

18. In order for an N channel E-MOSFET to conduct, the voltage applied to the gate must be
    a. Extremely high
    b. Greater than the threshold voltage
    c. Greater than zero
    d. Negative

19. When a positive voltage is applied to the gate, electrons are attracted from the _____, which creates an induced channel under the gate.
    a. Drain
    b. Gate
    c. Source
    d. Substrate

20. For a given V_{GS}, the drain current of a MOSFET will increases as the V_{DS} increases while in the _____ region.

21. Once the drain current no longer increases, the MOSFET is in the _____ region.

22. The point where $V_{DS} = V_{GS}- V_T$ is called the _____ voltage.
    a. Beta
    b. Cutoff
    c. Ohmic
    d. Pinch off

23. In order to calculate the drain current (I_D), you need
    a. Beta, V_{GS} and V_T
    b. Beta, V_{GS} and V_{DS}
    c. V_{GS} , V_{DS} and V_T
    d. V_T, Beta and V_P

24. In linear circuits, a MOSFET will operate in the _____ region.

25. In digital circuits, a MOSFET will alternate between the
    a. Ohmic and cutoff region
    b. Ohmic and saturation region
    c. Saturation and cutoff region

26. What are linear circuits predominately used for?

27. A common linear circuit is an enhancement mode common source MOSFET. What two quantities are applied to the gate?
    a. DC bias voltage and input signal
    b. DC bias voltage and resistive load
    c. Input signal and resistive load
    d. None of the above

28. In enhancement mode common source MOSFETs, the voltage gain produced is typically
    a. 1 to 5
    b. 2 to 10
    c. 10 to 25
    d. Greater than 100

29. MOSFETs are usually designated by the letter
    a. M
    b. Q
    c. R
    d. T

30. Drain resistors are commonly replaced by another MOSFET because the
    a. Circuit will respond faster
    b. Resistor values are limited
    c. Resistors are very unstable
    d. Resistors takes up 100X more space

31. In order to use a MOSFET as a drain resistor, you must
    a. Apply the appropriate bias voltage
    b. Connect the gate to the drain
    c. Neither of the above
    d. Both of the above

32. A MOSFET divider circuit has
    a. 2 MOSFETs in series with a drain resistor
    b. 2 MOSFETs connected in parallel
    c. 2 MOSFETs connected in series
    d. 3 MOSFETs connected in parallel

33. When a MOSFET circuit is used as a current source, it
    a. Draws a fixed input current
    b. Draws a variable input current
    c. Provides a fixed output current to a load
    d. Provides a variable output current to a load

34. A current sink is a circuit which
    a. Draws a constant current
    b. Draws a constant voltage across it
    c. Provides a constant output current
    d. Provides a constant voltage across it

35. A current mirror is a circuit which
    a. Distributes equal current to bias more than one MOSFET
    b. Is rarely used
    c. Is very complex
    d. Requires many resistors to distribute equal current

36. One of the most widely used amplifier configurations is the
    a. Averaging amplifier
    b. Differential amplifier
    c. Integrator
    d. Summing amplifier

37. What is the output voltage to a differential amplifier with a gain of 10, $V_1 = 5$ volts and $V_2 = 7$ volts?
    a. 2 volts
    b. 12 volts
    c. 35 volts
    d. –2 volts

38. What are the two main advantages of a cascade amplifier?

39. The Miller effect creates a capacitance at the amplifier input which
    a. Creates a high pass filter which increases the frequency response
    b. Creates a low pass filter which limits the frequency response
    c. Has little impact on the amplifier operation
    d. Reduces the gain of the amplifier

40. The Miller effect can be eliminated by
    a. Increasing the number of amplifiers
    b. Putting another capacitor in parallel
    c. Shorting out the capacitor
    d. Using a cascade connection

41. A common application for the source follower amplifier is
    a. For impedance matching
    b. To increase drain current
    c. To provide a high voltage gain
    d. None of the above

42. How many MOSFETs does a push pull power amplifier use to create the output signal?
    a. One
    b. Two
    c. Three
    d. Four

43. The push-pull amplifier operates as a
    a. Class A amplifier
    b. Class AB amplifier
    c. Class B amplifier
    d. Class C amplifier

44. In a push pull power amplifier, crossover distortion is eliminated by
    a. Applying a bias voltage that is approximately equal to the threshold voltage
    b. Applying a bias voltage that is much larger than the threshold voltage
    c. Applying the bias voltage to only one MOSFET
    d. Eliminating the bias voltage

45. The open loop gain of a MOSFET operational amplifier is typically as high as
    a. 1,000
    b. 10.000
    c. 100,000
    d. 1 million

46. MOSFET op amps are typically powered by
    a. A positive supply voltage
    b. A negative supply voltage
    c. Both a and b
    d. Neither a nor b

47. The MOSFET switch is the main component in all
    a. Digital circuits
    b. Linear and digital circuits
    c. Linear circuits
    d. Real time circuits

48. For an N channel MOSFET, when the gate voltage is zero, the MOSFET is ___ and the output is high.
    a. On
    b. Off
    c. Unable to determine

49. MOSFET switches are used to turn other devices on or off.
    a. True
    b. False

50. Spike suppressor diodes are used to
    a. Protect the MOSFET
    b. Protect the relays or other devices
    c. Protect the user
    d. Protect the wiring

51. The H bridge configuration can be used to energize two MOSFETS at one time in order to
    a. Control the direction of a DC Motor
    b. Protect a DC motor from too much heat
    c. Turn a DC motor off and on
    d. None of the above

52. The CMOS circuit uses both N and P channel MOSFETS which are used as an
    a. Current mirror
    b. Differential amplifier
    c. Inverter
    d. Power amplifier

53. The CMOS inverter is the basis for
    a. A few digital logic circuits
    b. All linear circuits
    c. Almost all amplifiers
    d. Almost all digital logic circuits

54. If the input to a CMOS inverter is +5 volts, the output will be _____ volts.
    a. +2.5
    b. +5
    c. 0
    d. –5

55. The BiCMOS is a combination of
    a. Bipolar transistors and CMOS logic circuits
    b. N channel and P channel MOSFETS
    c. Two or more logic circuits
    d. Various inverter circuits

56. In a BiCMOS, the bipolar transistors are used as the
    a. Energizing circuit
    b. Feedback circuit
    c. Input circuit
    d. Output circuit

57. The transmission gate is made with an N channel MOSFET in
    a. Parallel with a P channel MOSFET
    b. Parallel with another N channel MOSFET
    c. Series with a P channel MOSFET
    d. Series with another N channel MOSFET

58. If the control input to a transmission gate is positive
    a. Both MOSFETs conduct
    b. Neither MOSFET conduct
    c. The N channel MOSFET conducts
    d. The P channel MOSFET conducts

59. Name one common application for the transmission gate circuit.

60. In a sample/h old circuit, when the control input returns to zero, the capacitor
    a. Discharges back to zero
    b. Holds the last voltage value
    c. Is unaffected
    d. Starts to charge up

61. Why are MOSFETs sensitive to static electricity?

62. List three methods to protect a MOSFET from static electricity.