CHAPTER 10: VACUUM TUBES

1. What are the two principal electrodes in every tube?
   A. Plate and control grid
   B. Cathode and screen grid
   C. Plate and cathode*1
   D. Screen grid and control grid

2. For a given plate voltage, if negative potential on the control grid of triode is increased, the plate current
   A. decreases
   B. remains the same
   C. increases
   D. becomes zero

3. A vacuum diode can be used as
   A. an amplifier
   B. an oscillator
   C. a rectifier
   D. a regulator

4. Which generates the least noise in operation?
   A. Triode valve
   B. Tetrode valve
   C. Pentode valve
   D. Octode valve

5. A vacuum tube will conduct only if its plate is _____ with respect to the cathode.
   A. positive
   B. negative
   C. at zero potential
   D. at infinite potential

6. Saturation in a tube is a condition where an increase in plate voltage will produce
   A. a rise in electron emission
   B. a decrease in electron emission
   C. no appreciable change in plate current
   D. an appreciable change in plate current
7. A vacuum diode can be used as
   A. an amplifier
   B. an oscillator
   C. a rectifier
   D. a regulator

8. Which tube generates the greatest noise?
   A. Triode
   B. Tetrode
   C. Pentode
   D. Diode

9. Before ionisation, a gas- filled tube has a _______ resistance.
   A. very high
   B. very small
   C. small
   D. zero

10. The negative resistance characteristics of the tetrode is due to
    A. secondary emission
    B. plate being positive with respect to cathode
    C. control grid being negative with respect to cathode
    D. screen grid being negative with respect to cathode

11. What emitter is used in X-ray tubes?
    A. Thoriated tungsten
    B. Oxide-coated
    C. Tungsten
    D. Nickel

12. When the temperature of an emitter is increased two times, the electron emission
    A. increases two times
    B. increases four times
    C. increases several million times
    D. decreases two times
13. What is the typical life span of an oxide coated emitter?
   A. 500 hours
   B. 200 hours
   C. 1000 hours
   **D. 10000 hours**

14. The cathode heating time of thermionic glass diode is ________ that of a vacuum diode.
   A. the same as
   B. much less than
   **C. much more than**
   D. not related to

15. What is the solid state equivalent of thyratron?
   A. FET
   B. SCR
   C. BJT
   D. UJT

16. The grid to plate capacitance is least in ________ valve
   A. triode
   B. tetrode
   **C. pentode**
   D. diode

17. The peak inverse voltage of a diode is defined as the maximum allowable
   A. negative voltage across the load resistor
   **B. negative voltage applied to plate with respect to cathode**
   C. positive voltage to plate with respect to cathode
   D. positive voltage applied across the load resistor

18. The equation that defines the dc plate resistance of a vacuum tube.
   A. \( \frac{E_b}{I_b} \)
   B. \( I_b^2 \times E_b \)
   C. \( I_b \times E_b \)
   D. \( I_b/E_b \)
19. The voltage on the suppressor grid of a pentode is generally
   A. positive with respect to cathode
   B. positive with respect to cathode
   C. zero with respect to cathode
   D. at zero potential

20. Which of the following defines the amplification factor of a vacuum tube?
   A. $\Delta E_b/\Delta E_c$
   B. $\Delta I_b/\Delta E_b$
   C. $\Delta E_c/\Delta E_b$
   D. $\Delta E_b/\Delta I_c$

21. Which is the best tube for high frequency amplification?
   A. Triode valve
   B. Tetrode valve
   C. **Pentode valve**
   D. Diode valve

22. A triode is normally operated with control grid at _______ potential with respect to cathode.
   A. positive
   B. high positive
   C. zero
   D. **negative**

23. Once a thyratron is fired, its control grid _____ over plate current.
   A. **loses all control**
   B. exercises rough control
   C. exercises fine control
   D. becomes helpless

24. The _____ voltage should be reduced to zero to stop conduction in a thyratron.
   A. grid
   B. filament
   C. **plate**
   D. heater
25. What is the typical value of ac plate resistance for a triode?
   A. 1000 Ω
   B. 100 kΩ
   C. 1000 kΩ
   D. 10 Ω

26. Direct coupling is used for _____ amplification.
   A. very low frequency
   B. radio-frequency
   C. audio-frequency
   D. ultra high frequency

27. A vacuum diode acts as a rectifier because of its _______ conduction.
   A. unidirectional
   B. bidirectional
   C. isotropic
   D. omnidirectional

28. Directly heated cathode require _____ amount of heating
   A. very small
   B. large
   C. small
   D. very large

29. A hard tube is defined as a tube with
   A. a tungsten filament
   B. a gas in the envelope
   C. a metal envelope
   D. no gas in the envelope

30. What operation results in severest distortion?
   A. Class C
   B. Class B
   C. Class A
   D. Class AB
31. What is the typical plate efficiency of Class A amplifier?
   A. 50 %
   B. 75 %
   C. 30 %
   D. 10 %

32. For the sample plate dissipation, the output power of a Class B push-pull circuit is nearly _____ that of Class A operation.
   A. 2 times
   B. 4 times
   C. 3 times
   D. 5 times

33. The screen grid potential is kept ___ plate potential
   A. somewhat lower than
   B. same as
   C. somewhere higher than
   D. at zero potential with respect to

34. The output stage of a practical amplifier always employs what coupling?
   A. RC coupling
   B. Transformer coupling
   C. Direct coupling
   D. Impedance coupling

35. The plate resistance of a tube is mainly due to
   A. space charge
   B. electrodes of the tube
   C. vacuum in the tube
   D. gas in the tube

36. A vacuum tube is a ____ device.
   A. linear
   B. exponential
   C. non-linear
   D. bilateral
37. What is the unit of transconductance?
   A. Ohm
   B. Siemens/m
   C. Volt
   D. Siemens

38. Which provides the best frequency response?
   A. Transformer coupling
   B. RC coupling
   C. Direct coupling
   D. Impedance coupling

39. Voltage amplifiers are operated as _____ amplifiers.
   A. Class A
   B. Class B
   C. Class C
   D. Class AB

40. The PIV of hot cathode gas diode is _____ the equivalent vacuum diode.
   A. the same as that of
   B. less than
   C. more than
   D. independent that of

41. The anode-cathode potential of a gas-filled tube at which gas de-ionizes and stops conduction is called _____ potential.
   A. extinction
   B. ionizing
   C. striking
   D. reverse

42. For the same plate voltage, a gas diode can conduct _____ the equivalent vacuum diode.
   A. less current than
   B. same current as
   C. more current than
   D. one-half the current than
43. A thyatron can be used as
   A. an oscillator
   B. a controlled switch
   C. an amplifier
   D. an attenuator

44. A pentode is a _____ device.
   A. constant current
   B. linear
   C. constant voltage
   D. bilateral

45. The actual voltage gain of a triode amplifier is less than $\mu$ due to
   A. grid being negative with respect to cathode
   B. voltage drop in ac resistance of the tube
   C. plate being positive with respect to cathode
   D. voltage drop in dc resistance of the tube

46. For faithful amplification, the control grid should be _____ with respect to cathode.
   A. positive
   B. negative
   C. at zero potential
   D. at infinite potential

47. Which valve has the lowest amplification factor?
   A. Triode
   B. Pentode
   C. Tetrode
   D. Diode

48. Which of the following would have the most effect on decreasing the life of a vacuum tube?
   A. Too much of a grid excitation
   B. An excessive filament voltage
   C. A grid current that is too low
   D. A plate resistance value that is too high
49. Valves in a radio receiver generally employ _____ heated cathodes.
   A. directly
   B. indirectly
   C. oxide
   D. nickel

50. A vacuum diode acts as a ______ switch.
   A. bidirectional
   B. unidirectional
   C. controlled
   D. omnidirectional

51. Which can be used for proper high frequency amplification?
   A. Triode
   B. Tetrode
   C. Pentode
   D. Diode

52. The indirectly heated cathode of the diode is coated with
   A. thoriated tungsten
   B. nickel
   C. carbon
   D. strontium or barium oxide

53. What started the conduction in a cold cathode tube?
   A. Thermionic emission
   B. Natural sources
   C. Secondary emission
   D. Thermal sources

54. Which emitter is most commonly used in the tubes of a radio receiver?
   A. Tungsten
   B. Oxide coated
   C. Thoriated tungsten
   D. Constantan
55. What is the real measure of valve’s amplification capability?
   A. Plate resistance
   B. Transconductance
   C. Amplification factor
   D. Gain

56. Field emission is utilized in the mechanism of
   A. vacuum tubes
   B. gas-filled tubes
   C. mercury pool devices
   D. TV picture tubes

57. A vacuum tube is normally operated in the temperature saturation region.
   A. To protect against filament aging
   B. To keep the tube envelope hot
   C. To disperse the space charge
   D. Keep the tube envelope cold

58. Plate saturation results when
   A. filament voltage is too high
   B. space-charge region is depleted
   C. plate temperature is too low
   D. space-charge region is saturated

59. When the control grid of a triode is operated with positive potential with respect to cathode
   A. the grid resistance decreases
   B. the grid may overheat
   C. the plate current decreases sharply
   D. the grid resistance increases

60. What is the solid state equivalent of cold cathode diode?
   A. Zener diode
   B. LED
   C. Varactor
   D. Photodiode
61. The nose in a gas-filled tube is ____ that of a vacuum tube.
   A. the same as
   B. less than
   C. more than
   D. very much smaller than

62. What is the phase difference of the output and input voltage of a grounded-cathode amplifier?
   A. 90°
   B. 360°
   C. 270°
   D. 180°

63. A grid controlled vacuum tube acts as
   A. an amplifier
   B. a controlled switch
   C. a rectifier
   D. an oscillator

64. The filament voltage is a direct measure of
   A. filament temperature
   B. amplification
   C. plate temperature
   D. filament resistance

65. The equation that defines the ac plate resistance of a vacuum tube?
   A. ΔE_b/ΔE_c
   B. ΔI_b/ΔE_c
   C. ΔE_b/ΔI_b
   D. ΔE_c/ΔI_b

66. The transconductance of a pentode is ______ a triode.
   A. more than that of
   B. about the same as for
   C. less than that of
   D. not comparable to that of
67. The electrons emitted by a thermionic emitter are called
   A. free electrons
   B. **thermionic electrons**
   C. loose electrons
   D. bound electrons

68. The unit of work function of metals.
   A. Joules
   B. Watt-hour
   C. **Electron-volt**
   D. Watt

69. What is the typical operating temperature of an oxide coated cathode?
   A. 750°
   B. 500°
   C. 1200°
   D. 1000°

70. What is the amount of additional energy required to emit an electron from the surface of a metal?
   A. Surface barrier
   B. Threshold level
   C. **Work function**
   D. Potential

71. Oxide coated emitters have electron emission of ______ per watt of heated power.
   A. 5-10 A
   B. 50-100 A
   C. 50-150 mA
   D. **150-1000 mA**

72. What is the pentagrid converter?
   A. A tube with a total of five electrodes
   B. **A tube with a total of five grids**
   C. A tube that can be used for frequency conversion
   D. A tube that requires twice as such plate voltage as a single triode
73. Which emission is most widely used in practice?
   A. Field
   B. Secondary
   C. Thermionic
   D. Photo

74. What is the work function of an oxide coated cathode?
   A. 4.0 electron-volts
   B. 2.63 electron-volts
   C. 4.52 electron-volts
   D. electron-volts

75. A directly heated cathode has ____ warm-up time
   A. zero
   B. large
   C. small
   D. very large

76. Which thermionic emitter has the highest opening temperature?
   A. Oxide coated
   B. Tungsten
   C. Thoriated-tungsten
   D. Eureka

77. The internal resistance after ionization of a gas-filled tube is
   A. low
   B. very high
   C. high
   D. zero

78. One advantage of a mercury vapor diode over the high rectifier is
   A. its higher peak inverse voltage rating
   B. its reduced RF interference effect
   C. its lower voltage drop when the plate current is flowing
   D. the elimination of the need for a warm up period
79. The screen grid is used to
   A. increase the capacitance between the second grid and the plate
   B. decrease the capacitance between the control grid and the plate
   C. reduce the secondary emission effect
   D. lower the tube’s plate resistance

80. A tube tester is used to check a triode’s transconductance, which is the ratio of
   A. a small change in cathode current to the corresponding small change in grid current
   B. a small change in plate current to the corresponding small change in grid current
   C. a small change in plate voltage to the corresponding small change in plate current
   D. a small change in plate voltage to the corresponding small change in plate current

81. Which emitter is used in high voltage (>10 kV) applications?
   A. Tungsten
   B. Oxide coated
   C. Thoriated-tungsten
   D. Constantan

82. Which of the following is a desirable characteristic of an emitter?
   A. Large work function
   B. Small work function
   C. Very large work function
   D. Very small work function

83. When a thyratron tube has fired one thing that will cause it to stop conducting is
   A. a more positive on the plate
   B. a more negative voltage on the control electrode
   C. a more positive voltage on the control electrode
   D. a negative voltage on the plate

84. Secondary emission effects are undesirable in
   A. vacuum tubes
   B. gas-filled tubes
   C. ICs
   D. transistors
85. What would cause the plate current to increase in a pentode tube?
   A. A short circuit between the plate and the screen grid
   B. An open circuit in the lead that is connected to the
   C. A short circuit between the suppressor grid and the cathode
   D. A short circuit between the control grid and the cathode

86. In directly heated cathode, filament and cathode are
   A. separated components
   B. same components
   C. made of metals
   D. made of alloys

87. What is provided by transformer coupling?
   A. Impedance matching
   B. Step-up in voltage
   C. Good frequency response
   D. Stability of gain

88. What is one advantage of a pentode tube over a triode?
   A. Lower input impedance
   B. Lower output impedance
   C. Less noise internally generated
   D. Less control grid to plate capacitance

89. The load resistance $R$ in a triode amplifier should be nearly _____ for good amplification.
   A. $\frac{1}{2} r_p$
   B. $3 r_p$
   C. $r_p$
   D. $2 r_p$

90. A voltage amplifier is designed to have
   A. high $\mu$ and $R_L$
   B. low $\mu$ and high $R_L$
   C. high $r_p$ and low $R_L$
   D. high $\mu$ and low $R_L$
91. What transformer secondary voltage is utilized in a center-tap circuit?
   A. One-half
   B. One-third
   C. full
   D. One-eighth

92. Class C amplifiers are used as ____ amplifiers.
   A. audio-frequency voltage
   B. radio-frequency
   C. audio-frequency power
   D. audio-frequency current

93. The typical application of a cold cathode tube is as a
   A. diode
   B. tetrode
   C. triode
   D. pentode

94. Vacuum tube rectifiers are ____ affected by the changes in temperatures.
   A. not
   B. highly
   C. greatly
   D. severely

95. The internal resistance of a gas-filled tube is ____ that of a vacuum tube.
   A. the same as
   B. less than
   C. more than
   D. dependent

96. The ionization potential in a gas diode depends upon
   A. plate current
   B. size of the tube
   C. cathode construction
   D. type and pressure of gas
97. When the gas pressure in a gas-filled diode is increased, its PIV rating
   A. remains unchanged
   B. decreases
   C. increases
   D. becomes infinite

98. Ionization of cold cathode diode takes place at _____ plate potential compared to hot cathode gas diode.
   A. the same
   B. much lower
   C. much higher
   D. zero

99. A cold cathode diode is used as _____ tube.
   A. a rectifier
   B. a regulating
   C. a power-controlled
   D. an amplifying

100. For a conventional vacuum tube used in the UHF band
    A. The electron transit time becomes critical
    B. The distance between the control grid and the plate must be increased
    C. The physical size of the tube must be increased
    D. Only a pentode can be used because of noise effects

101. Ionization current which is a positive-ion current produced by collision between electrons and residual gas molecules in an electron tube is also called
    A. gas current
    B. gas discharge
    C. plasma current
    D. plasma discharge