1. One type of circuit control device which may be manual, automatic or multi-contact
   A. fuse
   B. breaker
   C. switch
   D. relay
   ANSWER: B

2. What are the primary methods of controlling electrical power?
   A. by using manual switches and rheostats
   B. by using variable reactance and transformers
   C. by using electronic switches, such as diodes, transistors thyratrons, and thyristors
   D. all of the above
   ANSWER: D

3. Common method(s) of controlling electrical power with reactance
   A. switching a tapped inductor
   B. using a saturable reactor
   C. by a matching transformer
   D. A and B above
   ANSWER: D

4. A reactive device used in controlling electrical power by using two windings on a common iron core. The control winding is supplied with small dc-current which causes the reactance of large ac-winding to change accordingly.
   A. tapped inductor
   B. saturable reactor
   C. auto transformer
   D. LVDT
   ANSWER: B

5. A saturable reactor with regenerative feedback.
   A. tapped inductor
   B. auto transformer
   C. LVDT
   D. magnetic amplifier
   ANSWER: D

6. Thyratrons in industrial electronics refers to _____.
   A. a gas-filled diode
   B. a vacuum tube
   C. gas-filled triode
   D. an electron triode
   ANSWER: C

7. An electronic switch that has the highest single-device current capacity and can withstand overloads better.
   A. Thyristors
   B. ignitrons
   C. SCR
   D. triac

ANSWER: B

8. A semiconductor, electronic switch that has the highest single-device current rating
   A. thyristor
   B. triac
   C. SCR
   D. Quadric
   ANSWER: C

9. The purpose of installing thyrectors across the incoming power lines to the speed control system is to _____
   A. cause the motor to caution
   B. protect drive circuits from high voltage transient surges
   C. increase the counter emf
   D. allow the field winding current to continue flowing
   ANSWER: B

10. Semiconductor devices equivalent to thyratrons are generally called
    A. thyrector
    B. thyristor
    C. diac
    D. ignitron
    ANSWER: B

11. Using electronic devices as switches, what is(are) the general methods of controlling electrical power?
    A. phase control
    B. zero-voltage switching
    C. static switching
    D. all of the above
    ANSWER: D

12. Which power control switching method that greatly generates RFI or EMI and is therefore limited to low-frequency applications?
    A. phase control
    B. zero-voltage switching
    C. inverter control
    D. static switching
    ANSWER: A

13. One of the electronic semiconductor devices known as diac, function as
    A. four terminal multi-directional switch
    B. two terminal bi-directional switch
    C. two terminal unidirectional switch
    D. three terminal bi-directional switch
    ANSWER: B

14. Which of the trigger diodes has the highest holding voltage?
    A. bidirectional-trigger diac
    B. bidirectional-diode-thyristor diac
    C. Shockley diode

D. thyrector
ANSWER: A

15. General term of electronic devices used to control or trigger large-power switching devices.
    A. thyristor
    B. thyrector
    C. break-over devices
    D. triggering devices
    ANSWER: C

16. A break-over device that is basically a diode.
    A. thyristor
    B. thyrector
    C. thyratron
    D. triggering diode
    ANSWER: D

17. A four-element solid state device that combi9nes the characteristics of both diodes and transistors
    A. varactor
    B. zener diode
    C. tunnel diode
    D. SCR
    ANSWER: D

18. The most popular thyristor used in electrical power controllers
    A. SCR
    B. triac
    C. SCS
    D. PUT
    ANSWER: A

19. Find the two stable operating conditions of an SCR.
    A. Conducting and non-conducting
    B. Oscillating and quiescent
    C. NPN conduction and PNP conduction
    D. Forward conducting and reverse conducting
    ANSWER: A

20. How do you stop conduction during which SCR is also conducting?
    A. remove voltage gate
    B. increase cathode voltage
    C. interrupt anode current
    D. reduce gate current
    ANSWER: C

21. How do we turn “ON” or trigger an SCR?
    A. by making the gate (G) positive with respect to its cathode (K)
    B. by making the gate (G) positive with respect to its anode (A)
    C. by making the cathode more positive with respect to the anode

D. A and C above
ANSWER: A

22. What is true about SCRs after they are being switched “ON”?
    A. The anode (A) to cathode (K) continues to conduct even if the gate triggering voltage is removed.
    B. The gate (G) must be provided with the required holding current to continue its conduction.
    C. A small holding voltage at the gate is required for a continuous conduction.
    D. B and C above
ANSWER: A

23. The voltage across the anode (A) and cathode (K) terminals of an SCR when conducting.
    A. holding voltage
    B. breakdown voltage
    C. breakback voltage
    D. trigger voltage
ANSWER: A

24. The minimum amount of current needed for an SCR to conduct continuously.
    A. holding current
    B. triggering current
    C. threshold current
    D. average sustaining current
ANSWER: A

25. What is(are) the condition(s) in triggering SCR?
    A. The gate voltage must be equal to or greater than the triggering voltage.
    B. The gate current must be equal to or greater than the triggering current.
    C. The anode (A) must be positive with respect to the cathode.
    D. all of the above
ANSWER: D

26. The voltage decreased across the anode (A) and cathode (K) of an SCR from non-conducting state to conducting state.
    A. holding voltage
    B. forward breakdown voltage
    C. triggering voltage
    D. breakback voltage
ANSWER: D

27. An SCR rated 10 A is used as the controlling switch in a circuit powered by 50Vdc. When the SCR fires ON, its anode (A) to cathode (K) voltage was observed to be 2 V. Calculate the breakback voltage of the SCR.
    A. 25 Vdc
    B. 32 Vdc
    C. 41 Vdc
    D. 48 Vdc
ANSWER: D

28. The needed voltage at the gate of an SCR before it conducts.
    A. minimum-gate trigger voltage
    B. maximum-gate trigger voltage
    C. minimum-gate peak-inverse voltage
    D. maximum-gate peak-inverse voltage
    ANSWER: A

29. What is(are) the gate limitation(s) of SCRs and triacs?
    A. maximum-gate power dissipation
    B. maximum-gate peak-inverse voltage
    C. maximum-gate trigger current and voltage
    D. all of the above
    ANSWER: D

30. How can we extend the rating of SCRs?
    A. by external cooling
    B. by external circuitry
    C. by connecting them in series/parallel
    D. all of the above
    ANSWER: D

31. Use of heat sinks, forced air, and water cooling are examples of external cooling in SCRs and other devices. Which of these is the only recommended to be used for the largest power dissipating device?
    A. metal heat sinks
    B. forced air
    C. water cooling
    D. A and B above
    ANSWER: C

32. How can we increase the forward-voltage blocking capability of SCRs?
    A. by connecting them in series
    B. by connecting them in parallel
    C. by cascading them
    D. by connecting back to back in parallel
    ANSWER: A

33. In connecting two SCRs in series, during “OFF” state, the voltage source must be properly shared between them, but due to devices’ differences, there might be unequal voltages across each SCR. How do we equalize these voltages?
    A. by installing a snubber circuit
    B. by adding a gate-to-cathode resistor
    C. by shunting a capacitor across the anode (A) and cathode (K) of each SCR
    D. by using a blocking-equalizing resistor
    ANSWER: D

34. What is true regarding blocking-equalizing resistors in SCRs connected in series?
    A. Blocking-equalizing resistors are shunted across each SCR.
    B. The value of these resistors is about 10% of the value of the blocking resistance of the SCR it is shunted with.
    C. These resistors increases the leakage current towards the load.

D. All of the above
ANSWER: D

35. A circuit used for voltage equalization during ON-OFF switching action of SCRs in series.
    A. snubber circuit
    B. crow-bar
    C. clipper
    D. clamper
    ANSWER: A

36. When a high current is needed, SCRs are connected in parallel. The problem with paralleled SCRs is, when they are not perfectly matched, one will conduct first before the other and carries the full-load current that is for sure greater than its maximum rating. To avoid this situation, both SCRs should be turned ON at the same time. How can we do this?
    A. by using high triggering gate voltage
    B. by using a gate-triggering transformer
    C. by using reactors
    D. all of the above are possible
    ANSWER: D

37. In controlling electrical power using phase control method with SCR/triac being the active device, what do we call the period of the cycle before the device switches to conduction?
    A. trigger time
    B. trigger delay time
    C. firing frequency
    D. firing delay angle
    ANSWER: D

38. How many times per second does an SCR is turned ON and OFF when it is operated in a full-wave phase control at a line frequency of 60 Hz?
    A. 30 times
    B. 60 times (HV)
    C. 90 times
    D. 120 times (FW)
    ANSWER: D

39. A three terminal device that behaves roughly like SCR, except that it can conduct current in either direction when at ON.
    A. thyristor
    B. SUS
    C. SBS
    D. GTO
    ANSWER: C

40. What is the difference between a triac and a silicon bilateral switch (SBS)?
    A. An SBS is usually used as breakover device, while a triac is a load controlling device.

B. An SBS is for low voltage applications, while a triac is generally for high voltage applications.
C. An SBS has better and stable symmetrical-firing voltage than a triac.
D. all of the above

ANSWER: D

41. A triac can be triggered ON by the application of a
A. positive voltage at the gate with respect to MT1
B. negative voltage at the gate with respect to MT1
C. positive or negative gate voltage with respect to MT2
D. all of the above are correct

ANSWER: D

42. Which are the three terminals of a TRIAC?
A. Gate, anode 1 and anode 2
B. Gate, source and sink
C. Base, emitter and collector
D. Emitter, base 1 and base 2

ANSWER: A

43. What are the three terminals of a triac?
A. anode 1 (A1), anode 2 (A2) and gate (G)
B. mainterminal 1 (MT1), mainterminal 2 (MT2), and gate (G)
C. anode (A), cathode (K) and gate (G)
D. both A and B are acceptable

ANSWER: D

44. A silicon bilateral switch may be considered as s small power triac, and has three terminals namely,
A. anode 1 (A1), anode 2 (A2) and gate (G)
B. mainterminal 1 (MT1), mainterminal 2 (MT2), and gate (G)
C. anode (A), cathode (K) and gate (G)
D. both A and B are acceptable

ANSWER: D

45. A thyristor that is very similar to an SCR except that it has low voltage and current ratings. It is very temperature stable, and is therefore suitable to be used as triggering device.
A. UJT
B. GTO
C. SBS
D. SUS

ANSWER: D

46. Silicon unilateral switches (SUSs) generally have a breakover voltage of 8 V, however, this value can be altered by normally connecting a zener diode. How is the diode installed?
A. across the gate (G) and cathode (K) terminals, with the diode's anode at the gate
B. anode to anode, cathode to cathode
C. diode's cathode to SUS's anode and diode's anode to SUS's cathode
D. diode's cathode to SUS's gate and diode's anode to SUS's cathode

ANSWER: D

47. A silicon unilateral switch (SUS) has a forward breakover voltage of 8 V. a zener diode is connected between its gate and cathode terminals with the diode's cathode at SUS's gate. If the zener voltage is 3.9 V, what is the new forward breakover voltage of the device?
    A. 0.49 V
    B. 2.05 V
    C. 4.50 V
    D. 11.9 V

    ANSWER: C

48. Thyristor whose characteristic curve closely resembles that of SCR's and SUS's, except that its forward breakover voltage (+VBO) is not alterable, for the device has no gate terminal.
    A. diac
    B. thyrector
    C. UJT
    D. Shockley diode

    ANSWER: D

49. What will happen to the forward breakdown or breakover voltage of SCRs and triacs if the gate current is increased?
    A. will decrease
    B. will also increase
    C. will not change
    D. will either increase or decrease, it depends on their current coefficient

    ANSWER: A

50. A UJT or unijunction transistor is a three terminal breakover-type switching device. Its three terminals are called base 1, base 2, and emitter. Though this is a transistor and has base and emitter terminals, this operates very different from a BJT and is not used as a linear amplifier. Its applications are for
    A. timers and oscillators
    B. signal generators
    C. triggering control for SCRs and triacs
    D. all of the above

    ANSWER: D

51. A UJT has an internal resistances of R_{B1} = 6 KΩ and R_{B2} = 3 KΩ, what is its interbase resistance?
    A. 2 KΩ
    B. 3 KΩ
    C. 6 KΩ
    D. 9 KΩ

    ANSWER: D

52. For a unijunction transistor (UJT) to witch ON
    A. the base 1 voltage should be greater than the peak voltage
    B. the base 2 voltage should be greater than the peak voltage
    C. the emitter voltage should be greater than the peak voltage

D. the voltage between the emitter and base 1 should be greater than the peak voltage when emitter being more positive

ANSWER: D

53. Semiconductor devices with inherent ON-OFF behavior and has no linear operating regions are called thryistors. Examples are SCRs, triacs, SUSs, SBSs, Shockley diodes, diacs, PUTs, and SCSs. In selecting thyristors for a particular application, which of the statement below is generally desirable?
    A. thyristors with high current and voltage ratings
    B. thyristors with high holding current/voltage
    C. faster thyristors
    D. thyristors with high breakback-voltage

ANSWER: D

54. Why does thyristors with high breakback voltage desirable?
    A. it dissipates less power
    B. it generates less heat
    C. it is more efficient
    D. all of the above

ANSWER: D

55. Portion in the welding process interval during which the welding current is flowing is called _____.
    A. cool sub-interval
    B. released interval
    C. squeeze interval
    D. heat sub-interval

ANSWER: D

56. In automatic welding system, basically there are how many intervals?
    A. 2
    B. 5
    C. 10
    D. 15

ANSWER: B

57. In automatic welding what do you call the first interval wherein the material to be welded are held together?
    A. squeeze interval
    B. weld interval
    C. hold interval
    D. standby interval

ANSWER: A

58. After the squeeze interval, what comes next in an automatic welding system?
    A. squeeze interval
    B. weld interval
    C. hold interval
    D. standby interval

ANSWER: B

59. During the welding or weld interval, when a welding current is flowing the system is said to be at
    A. weld interval
    B. cool subinterval
    C. heat subinterval
    D. hold interval
    ANSWER: C

60. The portion of the weld interval during which the current is absent
    A. cool subinterval
    B. heat subinterval
    C. hold interval
    D. standby interval
    ANSWER: A

61. After the welding interval, it goes to _____ interval wherein the electrode pressure is maintained on the metal surfaces.
    A. cool subinterval
    B. heat subinterval
    C. hold interval
    D. standby interval
    ANSWER: C

62. Next to hold interval is _____ interval in automatic welding system.
    A. squeeze
    B. cool
    C. standby
    D. release
    ANSWER: D

63. After the release interval in automatic welding, the system will go to
    A. cool interval
    B. squeeze interval
    C. standby interval
    D. hold interval
    ANSWER: C

64. Refers to the system that has no feedback and is not self correcting
    A. Close-loop system
    B. Coal slurry system
    C. Feed forward control system
    D. Open-loop system
    ANSWER: D

65. The system is _____ if a position servo system does not respond to small changes in the input.
    A. under stabilized
    B. underdamped
    C. stabilized
    D. overdamped
    ANSWER: D

66. What is the purpose of using a differential synchro instead of a regular synchro?
    A. Handles more signals only
    B. Performs addition and subtraction function only
    C. Differential synchros can handle more signals and also performs addition and subtraction function
    D. Handles two signals only
    ANSWER: C

67. Industrial circuit or system that is not self-correcting
    A. open-loop
    B. closed-loop
    C. system with feed back
    D. non-servo
    ANSWER: A

68. What do you call a circuit or system that is self-correcting?
    A. open-loop
    B. closed-loop
    C. system without feed back
    D. servo
    ANSWER: B

69. Open-loop in control system means:
    A. it has no feedback
    B. it is not self-correcting
    C. it is not self-regulating
    D. all are correct
    ANSWER: D

70. In control system, closed-loop means:
    A. it has feedback
    B. it is self-correcting
    C. it is self-regulating
    D. all are correct
    ANSWER: D

71. When a closed-loop system is used to maintain physical position it is referred as
    A. gyro system
    B. feedback system
    C. servo system
    D. differential system
    ANSWER: C

72. In closed-loop system, what do you call the difference in the measured value and the set value or desired value?
    A. error
    B. differential voltage
    C. potential difference
    D. threshold
    ANSWER: A

73. Error signal in closed-system is also known as
    A. difference signal
    B. deviation
    C. system deviation
    D. all are correct
    ANSWER: D

74. In a closed-loop control system, when the error signal is zero the system is at
    A. null
    B. saturation
    C. cut-off
    D. halt
    ANSWER: A

75. The small error signal or system deviation where the system cannot correct anymore
    A. threshold
    B. holding
    C. offset
    D. bias
    ANSWER; C

76. A good closed-loop control system has the following characteristics
    A. with very small offset signal or voltage
    B. quick response
    C. highly stable
    D. all are correct
    ANSWER: D

77. In control system, the manner in which the controller reacts to an error is termed as
    A. mode of operation
    B. type of operation
    C. mode of control
    D. reaction style
    ANSWER: C

78. What are the general basic modes of control in control system?
    A. On-Off
    B. Proportional
    C. Proportional plus integral
    D. Proportional plus derivative
    ANSWER: D

79. Mode of control wherein the controller has only two operating states. This mode is also known as bang-bang control.
    A. On-Off
    B. Proportional
    C. Proportional plus integral
    D. Proportional plus derivative
    ANSWER: A

80. _____ is a mode of control wherein the controller has a continuous range of possible position, not just two as in bang-bang control.
    A. On-Off
    B. Proportional
    C. Proportional plus integral
    D. Proportional plus derivative
    ANSWER: B

81. Proportional mode of control wherein the controller is not only considering the magnitude of the error signal but as well as the time that is has persisted.
    A. On-Off
    B. Proportional
    C. Proportional plus integral *
    D. Proportional plus derivative
    ANSWER: C

82. Proportional mode of control wherein the controller is not only considering the magnitude of the error signal but as well as its rate of change.
    A. Proportional
    B. Proportional plus integral
    C. Proportional plus derivative *
    D. Proportional plus integral plus derivative
    ANSWER: C

83. What is (are) being considered in Proportional plus Integral plus Derivative (PID) mode of control?
    A. error signal magnitude
    B. error signal period of occurrence
    C. error signal rate of change
    D. all are considered *
    ANSWER: D

84. If On-Off mode of control is the simplest, what is its opposite or the most complex?
    A. Proportional
    B. Proportional plus integral
    C. Proportional plus derivative
    D. Proportional plus integral plus derivative *
    ANSWER: D

85. The _____ are two of the most common mechanical configuration of industrial robots.
    A. Spherical and pneumatic
    B. Articulated arm and cylindrical *
    C. Spherical and hydraulic
    D. Jointed-arm and electric
    ANSWER: B

86. One advantage of hydraulic actuator in industrial robots include _____.
    A. great force capability handling heavy loads *
    B. lower operating cost than the other type
    C. low initial cost than the other type

D. clean-no oil leaks
ANSWER: A

87. _____ includes tow of the actuator type used in industrial robots.
A. Pneumatic and Jointed-arm
B. Hydraulic and Pneumatic
C. Electric and Spherical
D. Hydraulic and Cylindrical
ANSWER: B

88. A system in which the precise movement of a large load is controlled by a relatively weak signal.
A. hydraulic
B. electro
C. synchro
D. servo
ANSWER: D

89. A programmable, multifunction manipulator designed to move materials, parts, tools or specific devices.
A. Industrial robot
B. Android
C. Actuator
D. End effector
ANSWER: A

90. The technology for automations
A. avionics
B. cryogenics
C. cryotronics
D. robotics
ANSWER: D

91. What is(are) the common mechanical configurations for industrial robots?
A. articulated-arm or jointed-arm
B. spherical configuration
C. cylindrical configuration
D. all of these
ANSWER: D

92. The number of axis a robot is free to move is called
A. freedom axis
B. degrees of freedom
C. movement degrees
D. mechanical axis
ANSWER: B

93. Actuators used in industrial robots
A. electric motors
B. fluid motors
C. fluid cylinders

D. all of these are correct
ANSWER: D

94. Which of the actuators that has the greatest force capability?
A. electric
B. hydraulic fluid
C. pneumatic
D. magnetic
ANSWER: B

95. Actuator that requires the highest initial cost:
A. electric
B. hydraulic
C. pneumatic
D. magnetic
ANSWER: B

96. Robot actuator that has the highest operating cost:
A. electric
B. hydraulic
C. pneumatic
D. magnetic
ANSWER: B

97. The most messy robot actuator:
A. electric
B. hydraulic
C. pneumatic
D. magnetic
ANSWER: B

98. Advantages of electric actuators:
A. Lower initial cost than either hydraulic or pneumatic
B. Much lower operating cost than hydraulic
C. Accurate positioning and good velocity control
D. All of these are correct
ANSWER: D

99. Advantages of pneumatic actuators:
A. lower initial and operating cost than hydraulic actuators
B. Clean, no oil leaks
C. Quick response
D. All are correct
ANSWER: D

100. Advantages of hydraulic actuators
A. Great holding strength when stopped
B. Accurate positioning and good velocity control
C. Intrinsically safe in flammable environment such as painting
D. All of these are correct
ANSWER: D

101. Disadvantages of pneumatic actuators:
    A. Weak force capability
    B. Not so much holding strength when stopped as compared to hydraulic system
    C. Accurate positioning and velocity control is impossible
    D. All of these are correct
ANSWER: D

102. Disadvantages of electric actuators in industrial robots:
    A. Less force capability as compared to hydraulic system
    B. Very little holding strength when stopped which causes a heavy load to sag
    C. Usually requires mechanical brakes
    D. All are correct
ANSWER: D

103. A robot software or program that produces only two-position motion for a given robot axis.
    A. positive-stop
    B. point-to-point
    C. continuous-path
    D. hard interrupt
ANSWER: A

104. A robot program that has the ability to move a robot to any position within the range but without specific path.
    A. positive-stop program
    B. point-to-point program
    C. continuous path program
    D. compound program
ANSWER: B

105. A robot program that has the ability to move a robot to any position within the range with specific path.
    A. positive-stop program
    B. point-to-point program
    C. continuous path program
    D. compound program
ANSWER: C

106. When a robot moves on several axis at the same time, it is to have
    A. intrinsic motion
    B. extrinsic motion
    C. compound motion
    D. universal motion
ANSWER: C

107. In robotics, SCARA means:
    A. Selective Compliant Articulated Robot Arm
    B. Selective Compliant Assembly Robot Arm
    C. Selective Computer-Actuated Robot Arm
    D. A and B are correct

ANSWER: D

108. SCARA Robots has how many axis of motion?
   A. 2
   B. 4
   C. 6
   D. 8

ANSWER: B

109. SCARA Robots are designed for what applications?
   A. Machining
   B. Welding
   C. Assembling
   D. Handling heavy loads

ANSWER: C

110. Why is SCARA Robot attractive in industry?
   A. because it is relatively cheaper
   B. because it can carry very heavy loads
   C. because it has unlimited movement
   D. all of the above

ANSWER: A