Name of Post:	Junior Manager (Electrical/Mechanical/Civil/IT) under Assam Electricity Grid Corporation Limited (AEGCL)
Advt. No.	14/2023 dated 28.04.2023
Date of Exam.	26.11.2023

JM/AEGCL/EE/23

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Test Bo Series A

TEST BOOKLET

01585

Paper—II

(ELECTRICAL ENGINEERING)

Time Allowed : 2 Hours **Full Marks : 100**

Read the following instructions carefully before you begin to answer the questions :

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
3. All questions carry equal marks.

   The Answer-Sheet should be submitted to the Invigilator.

   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.

   Example :

   Suppose the following question is asked :

   The capital of Bangladesh is
   (A) Chennai
   (B) London
   (C) Dhaka
   (D) Dhubri

   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
5. Please ensure that the Test Booklet has the required number of pages (20) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.
10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

SEAL

[No. of Questions : 100]

1. A copper conductor having a length l and area of cross-section a has a resistance of 4 Ω. If the length of the conductor is doubled and the area of cross-section halved, then the new resistance will be

(A) 2 Ω

(B) 8 Ω

(C) 16 Ω

(D) None of the above

2. What will be the backup time of a UPS if it is backed by a 150 Ah, 12 V battery driving a load of 150 W?

(A) 14 h

(B) 16 h

(C) 12 h

(D) 10 h

3. Norton's equivalent circuit consists of a

(A) voltage source in parallel with impedance

(B) voltage source in series with impedance

(C) current source in series with impedance

(D) current source in parallel with impedance

4. It is required to convert a moving-iron galvanometer of current range of 15 mA and voltage range of 750 mV into an ammeter of range 2·5 A. What is the value of the shunt resistance required for this purpose?

(A) 0·3 Ω

(B) 1·5 Ω

(C) 3·4 Ω

(D) 0·5 Ω

5. An energy meter with a constant of 600 revolutions per unit is used for energy measurement. If it makes 500 revolutions in 30 seconds, find the energy consumed by the load for an hour.

(A) 1000 units

(B) 100 units

(C) 10 units

(D) 1 unit

6. In a single-phase R-L series circuit, the values of R and L are 40 Ω and 0·1 H. What will be the power factor of the circuit if the supply frequency is 50 Hz?

(A) 0·4

(B) 0·6

(C) 0·8

(D) 0·98

7. The electrical equivalent of reluctance is

(A) resistance

(B) inductance

(C) capacitance

(D) conductance

8. In measurement system, which of the following static characteristics is desirable?

(A) Accuracy

(B) Sensitivity

(C) Reproducibility

(D) All of the above

9. As per the maximum power transfer theorem, the maximum power is delivered from a source to a load when

(A) the load resistance is greater than the source resistance

(B) the load resistance is less than the source resistance

(C) the load resistance is equal to the source resistance

(D) None of the above

10. An electric circuit is shown in Fig. 1. The current flowing through the 2 Ω resistance is

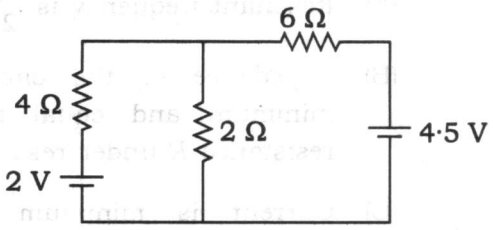

Fig. 1

(A) $\frac{15}{22}$ A upward

(B) $\frac{21}{44}$ A downward

(C) $\frac{21}{44}$ A upward

(D) $\frac{15}{22}$ A downward

11. The voltage wave applied to a single-phase electrical circuit is given by $v(t) = 230\sqrt{2}\sin(314\,t + 45°)$ volts. The r.m.s. value of the voltage in the circuit is

(A) 230 V

(B) 415 V

(C) $230\sqrt{2}$ V

(D) 314 V

12. Which of the following statements is correct regarding a resonant *R-L-C* series circuit?

(A) Resonant frequency is $\frac{R}{2\pi\sqrt{LC}}$.

(B) Impedance of the circuit is minimum and equal to the resistance *R* under resonance.

(C) Current is minimum in a resonant circuit.

(D) Under resonance, the power factor of the circuit is zero.

13. A balanced 3-phase delta-connected load consists of three resistances each of 8 Ω, connected to 400 V, 3-phase, 50 Hz mains. The phase current will be

(A) 5 A

(B) 50 A

(C) 500 A

(D) 5 kA

14. Calculate the e.m.f. induced in volts in the inductor of an *R-L* circuit having inductance of 1·8 H and resistance of 90 Ω, after 20 milli-second of connecting to a 20 V DC source.

(A) 7·36

(B) 14·72

(C) 9·4

(D) 3·6

15. In Fig. 2, find the value of inductance *L* in mH if the potential difference across the inductance is 62·8 V.

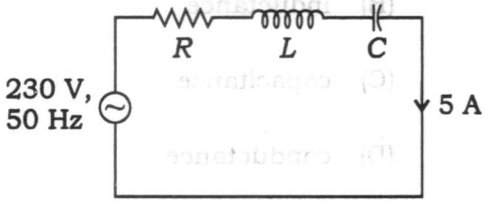

Fig. 2

(A) 30

(B) 40

(C) 20

(D) 10

16. What is the total eddy current loss in a laminated core for a supply frequency of 50 Hz at a maximum flux density of 2·0 T, if the core has an eddy current coefficient of 2, thickness of lamination of 4 mm and total volume of 20 m^3?

(A) 3·5 W

(B) 64 W

(C) 1·6 W

(D) 6·4 W

17. The current flowing in a circuit is $i(t)=18+10\sin\omega t+7\sin 2\omega t$. A moving-iron ammeter is connected in the circuit to measure the current. The reading of the meter will be approximately

(A) 28 A

(B) 35 A

(C) 18 A

(D) 20 A

18. Moving-coil permanent magnet instruments can be used for the measurement of

(A) both AC and DC

(B) AC only

(C) DC only

(D) half-wave rectified DC

19. The deflecting torque of a moving-iron instrument is

(A) $\frac{1}{2}I^2\frac{dL}{d\theta}$

(B) $I\frac{dL}{d\theta}$

(C) $I^2\frac{dL}{d\theta}$

(D) $\frac{1}{2}I\frac{dL}{d\theta}$

20. The correct expression for electrical power in a balanced 3-phase system is

(A) $3V_LI_L$

(B) $\sqrt{3}\,V_LI_L\cos\phi$

(C) $3V_LI_L\cos\phi$

(D) $\sqrt{3}\,V_LI_L$

21. Which type of magnetic material has relative permeability slightly greater than unity and is magnetized slightly?

(A) Ferromagnetic material

(B) Paramagnetic material

(C) Diamagnetic material

(D) None of the above

22. Which of the following substances is a good dielectric?

(A) Silver

(B) Mica

(C) Carbon

(D) Silicon

23. Every indicating instrument has a pointer to indicate the measurement. The pointer of an indicating instrument is generally made of

(A) copper

(B) aluminium

(C) silver

(D) soft steel

24. A measuring instrument may be an indicating instrument, recording instrument or integrating instrument. To which of these types does a watt-hour meter belong?

(A) Indicating

(B) Recording

(C) Integrating

(D) None of the above

25. Which of the following instruments can measure all of voltage, current and resistance?

(A) Multimeter

(B) Watt-hour meter

(C) Megger

(D) None of the above

26. A Wheatstone bridge is used to measure a low resistance as given in Fig. 3. If $I_g = 0$, then the value of X is

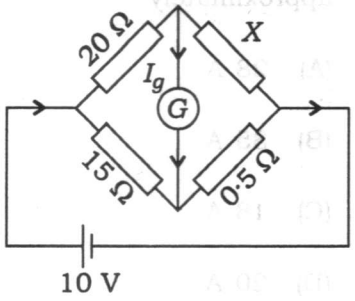

Fig. 3

(A) 2·25 Ω

(B) 0·67 Ω

(C) 1·5 Ω

(D) 2·5 Ω

27. The power in a 3-phase balanced circuit is measured by two-wattmeter method. If the r.m.s. values of the line voltage and line current are 415 V and 20 A respectively and power factor angle is 30° lagging, the readings of the wattmeters will be

(A) 4150 W, 3590 W

(B) 4150 W, 0 W

(C) 3590 W, 0 W

(D) 4150 W, 8300 W

28. Basically a potentiometer is a device for

(A) comparing two voltages

(B) measuring a current

(C) comparing two currents

(D) measuring a voltage

29. Which one of the following does not employ a null method of measurement?

(A) AC potentiometer

(B) Megger

(C) DC potentiometer

(D) Kelvin double bridge

30. The speed of a DC shunt motor can be increased by

(A) increasing the resistance in armature circuit

(B) increasing the resistance in field circuit

(C) reducing the resistance in field circuit

(D) reducing the resistance in armature circuit

31. For starting a DC motor, a starter is required because

(A) it limits the speed of the motor

(B) it starts the motor

(C) it limits the starting current to a safe value

(D) None of the above

32. If the field of a DC shunt motor gets opened while the motor is running

(A) the armature current will reduce

(B) the speed of the motor will reduce

(C) the motor will continue to run at constant speed

(D) the motor will attain dangerously high speed

33. In which of the following applications, DC series motor is invariably tried?

(A) Starter for a car

(B) Drive for a water pump

(C) Fan motor

(D) Motor operation in AC or DC

34. A DC shunt motor has an armature resistance of 2 Ω. What will be the armature current of the motor if the applied voltage is 250 V and the back e.m.f. is 225 V?

(A) 12·5 A

(B) 11·25 A

(C) 7·5 A

(D) 5·0 A

35. Speed vs. load current curves of different types of DC motors are given below (shown in Fig. 4). Which of the following curves denotes shunt motor characteristics?

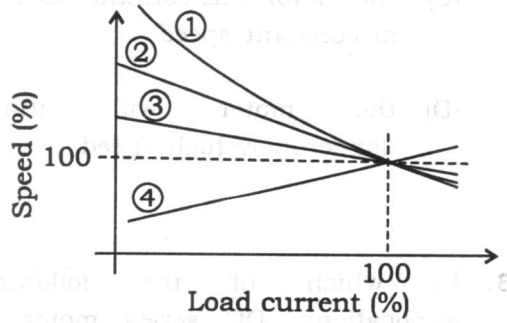

Fig. 4

(A) Curve 1

(B) Curve 2

(C) Curve 3

(D) Curve 4

36. The no-load voltage of a generator is 240 V and the rated load voltage is 220 V. The voltage regulation of the generator is

(A) 4·5%

(B) 11·3%

(C) 2·8%

(D) 9·1%

37. Which of the following connections of transformer will give the highest secondary voltage?

(A) Delta primary, delta secondary

(B) Star primary, star secondary

(C) Delta primary, star secondary

(D) Star primary, delta secondary

38. What is the full-load secondary current of a 100 kVA, 11 kV/440 V, 3-phase distribution transformer?

(A) 75·76 A

(B) 131 A

(C) 27·27 A

(D) 54·54 A

39. A single-phase transformer has a rating of 15 kVA, 600 V/120 V. It is connected as an autotransformer to supply 720 V from a 600 V primary source. The maximum load it can supply is

(A) 18 kVA

(B) 90 kVA

(C) 15 kVA

(D) 12 kVA

40. The full-load copper loss and iron loss of a transformer are 6400 W and 5000 W respectively. The copper and iron losses at half load will be respectively

(A) 3200 W and 2500 W

(B) 3200 W and 5000 W

(C) 1600 W and 5000 W

(D) 1600 W and 2500 W

41. A 500 kVA, 3-phase transformer has iron loss of 300 W and full-load copper loss of 600 W. The percentage load at which the transformer is expected to have maximum efficiency is

(A) 50%

(B) 70·7%

(C) 141·4%

(D) 95%

42. For the same kVA rating, the leakage flux in an induction motor is _____ that of a transformer.

(A) more than

(B) less than

(C) about the same as

(D) None of the above

43. The rotor winding of a 3-phase wound rotor induction motor is generally _____ connected.

(A) star

(B) delta

(C) partly star and partly delta

(D) None of the above

44. The speed of a squirrel-cage induction motor can be changed by

(A) pole changing

(B) rheostatic control

(C) cascade control

(D) None of the above

45. A 4-pole, 50 Hz induction motor operates at 5% slip. The frequency of the e.m.f. induced in the rotor will be

(A) 25 Hz

(B) 50 Hz

(C) 2·5 Hz

(D) 35 Hz

46. The stator of a 3-phase squirrel-cage induction motor is wound to produce 2 pairs of poles. The full-load slip of the motor is 4%. Find the full-load speed in r.p.m. when the motor is connected to 3-phase, 415 V, 50 Hz supply.

(A) 2880

(B) 1500

(C) 3000

(D) 1440

47. Synchronous motor absorbs reactive power when it is

(A) under-excited

(B) over-excited

(C) normal excited

(D) None of the above

48. The purpose of starting winding in a single-phase induction motor is to

(A) reduce losses

(B) limit temperature rise of the machine

(C) produce rotating field in conjunction with main winding

(D) None of the above

49. In a synchronous motor, with field under-excited, the power factor will be

(A) leading

(B) lagging

(C) unity

(D) None of the above

50. Which one of the following fractional horsepower motors is the least expensive?

(A) Shaded-pole motor

(B) Capacitor-start motor

(C) Split-phase motor

(D) AC series motor

51. The field winding of an alternator is excited by

(A) DC only

(B) AC only

(C) both DC and AC

(D) thyristor

52. The armature winding of an alternator is

(A) always star connected

(B) generally delta connected

(C) star-delta connected

(D) None of the above

53. The speed at which a 6-pole alternator should be driven to generate a frequency of 50 cycles per second is

(A) 1500 r.p.m.

(B) 1000 r.p.m.

(C) 500 r.p.m.

(D) 1250 r.p.m.

54. The power factor on which an alternator operates depends on

(A) speed of the prime mover

(B) armature losses

(C) copper losses

(D) nature of load

55. The maximum power developed by a synchronous motor depends on

(A) supply voltage (V) only

(B) rotor excitation voltage (E_f) only

(C) both supply voltage and rotor excitation voltage

(D) supply voltage, rotor excitation voltage and maximum value of load angle

56. The knowledge of diversity factor helps in computing

(A) plant capacity

(B) average load

(C) peak load

(D) units (kWh) generated

57. A power supply has domestic load having a maximum demand of 1500 kW. If the diversity factor and demand factor are 1·2 and 0·8 respectively, then the connected domestic load is

(A) 1800 kW

(B) 2500 kW

(C) 2250 kW

(D) 1750 kW

58. The principle of solar power is based on

(A) thermoelectric effect

(B) photoelectric effect

(C) electromagnetic induction

(D) nuclear fission

59. In V-curves of synchronous motor, the graph is drawn between

(A) terminal voltage and load factor

(B) armature current and power factor

(C) field current and armature current

(D) field current and power factor

60. The difference in voltage at the receiving end of a transmission line between conditions of no load and full load is called

(A) receiving-end voltage

(B) sending-end voltage

(C) transmission efficiency

(D) voltage regulation

61. Corona loss can be reduced by the use of hollow conductor because

(A) the current density is reduced

(B) the eddy current in the conductor is eliminated

(C) for a given cross-section, the radius of the conductor is increased

(D) of better ventilation in the conductor

62. Which of the following distribution systems is more reliable?

(A) Radial system

(B) Tree system

(C) Ring main system

(D) All are equally reliable

63. The main consideration in designing of feeder is

(A) reactive power limit

(B) both atmospheric condition and current-carrying capacity

(C) atmospheric condition only

(D) current-carrying capacity only

64. Step potential and touch potential are associated with

(A) earthing of substation

(B) high voltage transmission

(C) voltage rise in generator

(D) communication system

65. An HRC fuse is

(A) a wire of platinum

(B) a heavy cross-section of copper or aluminium

(C) a ceramic body having metal end caps

(D) a ceramic tube having carbon rod inside it

66. The empirical formula commonly employed for determination of spacing of conductors for an aluminium conductor line is

(A) spacing $= \sqrt{S} + \frac{V}{150}$ metre

(B) spacing $= \sqrt{S} + \frac{150}{V}$ metre

(C) spacing $= \sqrt{S} - \frac{150}{V}$ metre

(D) spacing $= \sqrt{S} - \frac{V}{150}$ metre

67. The function of earth wire is

(A) to carry current in case of fault

(B) to protect the human body from electric shock

(C) to transfer leakage current to ground

(D) All of the above

68. What type of protection is used for LT lines passing through agricultural field?

(A) Zero factor protection

(B) Lewis defence

(C) Direct protection

(D) PVC protection

69. Which relay is used for feeder protection?

(A) Under-voltage relay

(B) Translay relay

(C) Thermal relay

(D) Buchholz relay

70. Which of the following relays is used for the protection of feeders and large busbars?

(A) Under-frequency relay

(B) Buchholz relay

(C) Distance relay

(D) Differential relay

71. The full form of TRS is

(A) Triple Rubber Sheathed

(B) Twin Rubber Sheathed

(C) Tough Rubber Sheathed

(D) Totally Reverse Switch

72. How many earth connections are required for the motor frame as per IE Rule 61?

(A) Only one earth connection

(B) Two inter-connected earth connections

(C) Two separate and distinct earth connections

(D) None of the above

73. What is the minimum size of a single-core PVC-insulated aluminium conductor cable for using in domestic lighting circuit?

(A) $1{\cdot}5\ mm^2$

(B) $1{\cdot}0\ mm^2$

(C) $2{\cdot}5\ mm^2$

(D) $3{\cdot}6\ mm^2$

74. In order to reduce the cost of generation of electrical energy, the values of diversity factor (DF) and load factor (LF) should be

(A) both DF and LF high

(B) LF low and DF high

(C) LF high and DF low

(D) both DF and LF low

75. A circuit breaker is a

(A) current-controlling device

(B) current-interrupting device

(C) current-limiting device

(D) All of the above

76. The most common fault on an overhead transmission line is

(A) single line to ground fault

(B) three-phase short circuit fault

(C) double line to ground fault

(D) line to line fault

77. The transmission of electric power is carried out at high voltage because it reduces

(A) the volume of the conductor material

(B) percentage line drop

(C) both (A) and (B)

(D) line current

78. The line voltage of a 2-wire DC system is raised from 200 V to 400 V for the same power transmitted over the same distance having the same power loss. What is the current supplied by 400 V system shown in Fig. 5?

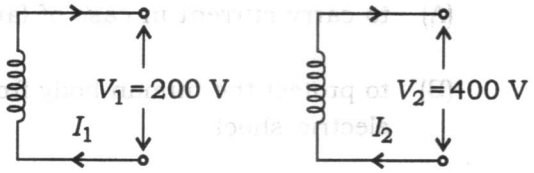

Fig. 5

(A) $I_2 = I_1$ (B) $I_2 = 0{\cdot}5I_1$

(C) $I_2 = 2I_1$ (D) $I_2 = 1{\cdot}5I_1$

79. A single-core cable has a conductor diameter of 1 cm and insulation thickness of 0·4 cm. If the specific resistance of insulation is $5 \times 10^{12}\ \Omega$-m, then the insulation resistance of 2 km cable will be (take $\log_e 1{\cdot}8 = 0{\cdot}588$)

(A) 234 MΩ (B) 117 MΩ

(C) 468 MΩ (D) 250 MΩ

80. Observe the following logical relations :

(i) $(A + B)' = A' \cdot B'$

(ii) $(A \cdot B)' = A' + B'$

(iii) $(A + B)' = A' + B'$

(iv) $(A \cdot B)' = A' \cdot B'$

Two of the above relations are as per De Morgan's law. They are

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (iii) and (iv)

(D) (ii) and (iv)

81. The dual of $x \cdot \bar{x} = 0$ is

(A) $\bar{x} + x = 0$

(B) $x + \bar{x} = 1$

(C) $\bar{x}x = 1$

(D) $x + \bar{x} = 0$

82. A flip-flop has two outputs which are

(A) always 0

(B) always 1

(C) always complementary

(D) None of the above

83. Three Boolean operators are

(A) NOT, OR, NAND

(B) NOT, OR, AND

(C) NOT, OR, NOR

(D) NOT, NOR, NAND

84. The output of a two-input AND gate is high

(A) only if both the inputs are high

(B) only if both the inputs are low

(C) only if one input is high and the other input is low

(D) if at least one of the inputs is low

85. MOSFET is a

(A) voltage-controlled device

(B) current-controlled device

(C) passive device

(D) bipolar device

86. A unique feature of complementary metal oxide semiconductor (CMOS) is

(A) slow speed of operation

(B) low packing density

(C) very low power consumption

(D) bad immunity to external noise

87. Tunnel diodes are usually made of

(A) Si and GaAs

(B) Si and InSb

(C) Ge and GaAs

(D) Ge and InSb

88. An op-amp is a linear integrated circuit that has

(A) a very high voltage gain

(B) a high input impedance

(C) a low output impedance

(D) All of the above

89. In a transistor, α and β denote the common-emitter current amplification factor and the common-base current amplification factor. The relation between α and β is

(A) $\beta = \frac{\alpha}{1-\alpha}$

(B) $\alpha = \frac{\beta}{1-\beta}$

(C) $\beta = \frac{\alpha}{1+\alpha}$

(D) $\alpha = \frac{1-\beta}{\beta}$

90. Execution of two or more programs by a single CPU is known as

(A) multiprogramming

(B) multiprocessing

(C) time-sharing

(D) None of the above

91. C is which level language?

(A) High level

(B) Low level

(C) Low and high level

(D) None of the above

92. The chart that contains only function flow and no code is called

(A) flowchart

(B) structure chart

(C) Both (A) and (B)

(D) None of the above

93. An AC voltage wave represented by $v = 322 \sin 314t$ is rectified to DC voltage by a bridge rectifier. Calculate the average output DC voltage in volts across the load.

(A) 230

(B) 335

(C) 205

(D) 102

94. Direct arc furnaces have which of the following power factors?

(A) Lagging

(B) Leading

(C) Unity

(D) None of the above

95. The only method which can be used for preheating of plastic preforms to proper temperature uniformly is

(A) dielectric heating

(B) resistance heating

(C) induction heating

(D) eddy current heating

96. The lightning arrester acts as

(A) surge absorber

(B) surge diverter

(C) surge coil

(D) surge reflector

97. What is the maximum permissible load for a power subcircuit as per IE Rules?

(A) 800 watts

(B) 1500 watts

(C) 2000 watts

(D) 3000 watts

98. SMPS is used for

(A) obtaining controlled AC power supply

(B) obtaining controlled DC power supply

(C) storage of DC power

(D) None of the above

99. When a pure semiconductor is heated, its resistance

(A) increases

(B) decreases

(C) remains the same

(D) cannot be predicted

100. The minimum value of the anode current in an SCR that is required to sustain conduction in a thyristor with zero gate current is called

(A) fundamental current

(B) base current

(C) holding current

(D) latching current

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