Jr. Engg.-2022 (Elect.) EJE/22

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE ASKED TO DO SO.

2022

TEST BOOKLET

Electrical Engineering

Time allowed : 2 hours

Full marks : 200

Answer ***all*** the questions.

Questions are of equal value.

TEST BOOKLET SERIES

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Serial No. .....

Roll No.:

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INSTRUCTIONS

Candidates should read the following instructions carefully before answering the questions:

1. This booklet consists of 12 pages including this front page, containing 100 questions. **Verify the Page Nos. and Test Booklet series on each page and bring at once to the Invigilator's notice any discrepancy.**
2. Answers will have to be given in the OMR Sheet supplied for the purpose.
3. Before you proceed to mark in the OMR Sheet in response to various items in the Test Booklet, you have to fill in some particulars in the OMR Sheet. ***Do not fold the OMR Sheet as this will result in error in your marks.***
4. All questions are of multiple-choice answer-type. You will find ***four*** probable answers **(A)**, **(B)**, **(C)** and **(D)** against each question. Find out which of the four answers appears to you to be correct or the best. Now darken the circle corresponding to the letter of the selected answer in the OMR Sheet with **Black Ball Point Pen.**
5. One and only one circle is to be fully blackened for answer. Any spot in any other circle (multiple circle) or in wrong circle will be considered as wrong answer. If more than one circle is encoded for a particular answer, it will be treated as a wrong answer. Use of whitener is strictly prohibited.
6. ***There will be negative marking of $\frac{2}{3}$ mark for each wrong answer.***
7. ***There is a blank page at the end of this Booklet for Rough Work.***
8. ***The OMR Sheet should be handed over to the Invigilator before leaving the Examination Hall. You are permitted to take away the used Test Booklet after completion of the examination.***

1. A generating station which has a high investment cost and low operating cost is usually operated as a

(A) Peak load station
(B) Base load station
(C) Medium load station
(D) None of the above

2. Under the poles of an induction disc relay, the disc rotates from

(A) shaded pole to unshaded pole
(B) unshaded pole to shaded pole
(C) depends upon CT secondary connection
(D) depends upon magnitude of current

3. Swamping resistance is used to compensate error due to

(A) stray magnetic field
(B) temperature variations
(C) large supply variations
(D) None of the above

4. Rectifier moving coil instruments respond to

(A) peak value, irrespective of the nature of the waveform.
(B) average value, for all waveforms.
(C) rms value for all waveforms.
(D) rms value for symmetrical square waveforms.

5. If the number of poles in a wave wound generator is doubled then the generated emf will

(A) become half.
(B) become double.
(C) increase to four times.
(D) remain constant.

6. The damping ratio of the characteristic equation $s^2 + 2s + 8 = 0$ is

(A) 0·353
(B) 0·350
(C) 0·30
(D) 0·333

7. Sumpners test is carried out

(A) mainly to find out the temperature rise on full load economically.
(B) mainly to find out efficiency of the transformer.
(C) mainly to find out regulation of the transformer.
(D) due to none of the above reasons.

8. Cross-section of the iron core of a power transformer is approximately circular. This is done because

(A) it is easy to prepare circular coils.
(B) it is easy to assemble circular iron core.
(C) electromagnetic forces tend to make the coil circular.
(D) All of the above

9. What is the rms value of rectangular voltage wave with amplitude of 100 V?

(A) $50\sqrt{2}$ V
(B) 100 V
(C) 110 V
(D) $(100/\sqrt{2})$ V

10. The peak factor of a triangular ac voltage wave is

(A) 1
(B) 1.11
(C) 1.41
(D) 1.732

11. In a microprocessor, the address of the next instruction to next executed, is sorted in

(A) Stack pointer
(B) Address latch
(C) Program counter
(D) General purpose register

12. Which of the following equipment is not installed in a substation?

(A) Shunt reactors
(B) Excitors
(C) Voltage transformers
(D) Series capacitors

13. In modern electronic multimeters, a FET or MOSFET is preferred over BJT because

(A) its input resistance is high.
(B) its input resistance is high and does not vary with the change of range.
(C) its input resistance is low.
(D) it is cheaper.

14. In Ward Leonard control change in speed of motor can be obtained by varying

(A) supply voltage of the dc motor.
(B) field excitation of dc motor.
(C) armature voltage of dc motor.
(D) armature current of dc motor.

15. In a pure inductive circuit if the supply frequency is reduced to half, the current will be

(A) reduced to one fourth.
(B) reduced by half.
(C) doubled.
(D) four times at high.

16. A diode having breakdown voltage of greater than 5 V and a +ve temperature coefficient is

(A) Zener diode
(B) Avalanche diode
(C) Tunnel diode
(D) P-N junction diode

17. A solenoid produces a flux of 12 m Wb and a flux density of 0.9 Tesla. The inside diameter of the solenoid must be

(A) 5 cm
(B) 10 cm
(C) 13 cm
(D) 130 cm

18. Nuclear power station is normally used for

(A) peak load
(B) base load
(C) average load
(D) any load

19. Which of the following dc generator can build up without any residual magnetism in the poles?

(A) Compound generator
(B) Self-excited generator
(C) Series generator
(D) Shunt generator

20. The per unit value of a 2 ohm resistor at 100 MVA base and 10 KV base voltage is

(A) 4 pu
(B) 2 pu
(C) ½ pu
(D) 0·2 pu

21. For measuring positive, negative and zero sequence voltages in a system, the reference taken as

(A) neutral of the system only
(B) ground only
(C) for zero sequence neutral and for positive and negative the ground
(D) None of the above

22. Insulation resistance of high voltage circuit breakers is more than

(A) 1M ohm
(B) 20M ohms
(C) 100M ohms
(D) 500M ohms

23. The maximum swing of the rotor beyond which the swing of torque angle leads to loss of transient stability is called as

(A) Maximum Power Angle
(B) Critical Clearing Angle
(C) Stability Angle
(D) None of the above

24. Diversity factor is always

(A) 1
(B) 0
(C) greater than 1
(D) infinity

25. The electric field intensity of an equipotential surface is

(A) always perpendicular to the surface.
(B) always parallel to the surface.
(C) zero.
(D) None of the above

26. The negative maximum value of a Cosine wave form occurs at

(A) 270 degrees
(B) 180 degrees
(C) 90 degrees
(D) 0 degree

27. The inductance of a coil can be increased by

(A) choosing core material having high relative permeability.
(B) increasing core length.
(C) decreasing the number of turns.
(D) decreasing the diameter of the factor.

28. Bundle conductors are used in transmission lines, the effective capacitance and inductance will respectively

(A) decrease and increase.
(B) increase and decrease.
(C) remain same and increase.
(D) decrease and remain same.

29. A dc series motor develops a torque of 10Nm at 1A of load current. If the current is increased to 2A, the torque developed will be

(A) 80Nm
(B) 40Nm
(C) 20Nm
(D) 10Nm

30. In an Extra High Voltage overhead transmission line earth wire is provided to protect the line against

(A) switching surge
(B) lightening surge
(C) corona effect
(D) ensure fault voltages

31. When an alternator is delivering a balanced load at unity power factor the phase angle (in degrees) between line voltage and line current is

(A) 90
(B) 60
(C) 30
(D) 0

32. Two infinitely long parallel conductors in vacuum and separated 1 metre between centres when a current of 1 ampere flows through each conductor, produce on each other a force–

(A) 2×10^{-7} N/m
(B) 2×10^{-5} N/m
(C) 2×10^{-3} N/m
(D) 2×10^{-2} N/m

33. If copper loss of a transformer at 1/4th full load is 100 W, then its full load copper loss would be

(A) 100 W
(B) 400 W
(C) 800 W
(D) 1600 W

34. When the power is to be transmitted over a distance of 300 km, the transmission voltage should be in the range of

(A) 33 KV
(B) 66 KV
(C) 132 KV
(D) 220/400 KV

35. When a fault occurs in a power system the zero sequence component of current becomes zero. The type of fault is

(A) three phases to ground fault
(B) double line fault
(C) double line to ground fault
(D) single line to ground fault

36. Assuming carrier mobility to be temperature independent it can be shown that pure silicon (E_g = 0·7 eV) have the same conductivity at a temperature of

(A) 191 K
(B) 300 K
(C) 471 K
(D) 1470 K

37. Hydrogen can be used a medium for

(A) energy transformation
(B) energy storage
(C) Both (A) and (B)
(D) for electrolysis

38. If the voltage at a dc shunt motor terminal is halved, load torque being the armature current will be

(A) Halved
(B) Doubled
(C) Unaltered
(D) Zero

39. A 10 ohm load is connected to the secondary of a single phase 3300110 V power transformer. The effective load on the 3.3 kV bus bar is nearly

(A) 0.9 k ohm
(B) 9 k ohm
(C) 10 k ohm
(D) 300 k ohm

40. Load factor is defined as

(A) peak load/average load
(B) maximum load/minimum load
(C) average load/peak load
(D) peak load/rated load

41. In a three-phase half-wave rectifier if the input phase voltage is 200 V, the PIV required for each diode will be

(A) 400 V
(B) 346 V
(C) 370 V
(D) 200 V

42. The voltmeter of choice for measuring the emf of a 100 V dc source would be

(A) 100 V, 1 mA
(B) 100 V, 2 mA
(C) 100 V, 10 K ohm/V
(D) 100 V, 100 K ohm/V

43. A 150 V moving iron voltmeter of accuracy class 1·0 reads 75 V when used in a circuit under standard conditions. The maximum possible percentage error in the reading is

(A) 0·5
(B) 1·0
(C) 2·0
(D) 4·0

44. Pure inductive circuit takes power from the ac line when

(A) applied voltage increases but current decreases.
(B) applied voltage decreases but current increases.
(C) both applied voltage and current rise.
(D) both applied voltage and current decrease.

45. With usual meaning of δ, beyond the steady state stability limit, the magnitude of real power transfer

(A) increases with increase in δ.
(B) decreases with decrease in δ.
(C) remains independent of δ.
(D) decreases with increase in δ.

46. Normally Zbus matrix is a

(A) Null matrix
(B) Sparse matrix
(C) Full matrix
(D) Unity matrix

47. For short term planning problem losses can be found out

(A) by using appropriate loss formula
(B) by load flow studies
(C) by carrying out stability studies
(D) can be ignored

48. The presence of earth in case of overhead lines

(A) increases the capacitance.
(B) decreases the capacitance.
(C) increases the inductance.
(D) decreases the inductance.

49. In a highly capacitive circuit the

(A) actual power is more than its reactive power.
(B) reactive power is more than the actual power.
(C) reactive power is more than the apparent power.
(D) apparent power is equal to the actual power.

50. In a dc motor the developed torque is 200N-m at 600 rpm. At 500 rpm the motor torque would be

(A) 133N-m
(B) 167N-m
(C) 180N-m
(D) 200N-m

51. Which of the following frequencies has the longest time period?

(A) 1 Hz
(B) 1 kHz
(C) 10 Hz
(D) 10 kHz

52. The effects of power factor and frequency variations in wattmeter can be reduced if

(A) pressure coil induction is zero.
(B) a capacitance is connected in parallel to pressure coil.
(C) damping is not provided.
(D) voltage coil resistance is zero.

53. In Hopkinson's test for dc motors

(A) speeds of the motors are separately controlled.
(B) both motors are run as generators.
(C) both machines are mechanically coupled.
(D) both motors run at their respective rated speeds.

54. A shunt generator running at 1000 rpm has generated emf as 100 V. If the speed increases to 1200 rpm, the generated emf will be nearly

(A) 120 V
(B) 140 V
(C) 175 V
(D) 240 V

55. An average emf of 10V is induced in a 100 turn solenoid as the result of a change in flux which occurs in 0.5 second. The total flux change is

(A) 0.05 Wb
(B) 0.5 Wb
(C) 5 Wb
(D) 50 Wb

56. A shunt reactor is added at the infinite bus, which is fed by the synchronous generator. The stability limit will

(A) decrease
(B) increase
(C) remain the same
(D) Any of the above

57. A conductor is composed of seven identical copper strands each having a radius r, the self GMD of the conductor will be

(A) r
(B) $3{\cdot}177\, r$
(C) $2{\cdot}177\, r$
(D) None of the above

58. A moving coil galvanometer has a resistance of 5 ohms and gives full scale deflection when carrying 50 milli amperes. The instrument can be used to measure 100 volts by connecting in series with the instrument a resistance of

(A) 1000 ohms
(B) 2000 ohms
(C) 1995 ohms
(D) 5000 ohms

59. Consider a single crystal of an intrinsic semiconductor. The number of free carriers at the Fermi level at room temperature is

(A) half the total number of electrons in the crystal.
(B) half the number of free electrons in the crystal.
(C) half the number of atoms in the crystal.
(D) zero.

60. Fuel cell converts

(A) chemical energy into electrical energy.
(B) mechanical energy into electrical energy.
(C) solar energy to electrical energy.
(D) wind energy to electrical energy.

61. If two spheres of radii R_1 and R_2 ($R_2 > R_1$) are connected by a conducting wire and each of the spheres has a charge q, which of the following statements is then true?

(A) Sphere of radius R_1 will have zero potential.

(B) Sphere of radius R_1 will have greater potential.

(C) Sphere of radius R_2 will have greater potential.

(D) Potentials of both the spheres will be equal.

62. In a series circuit on resonance, following will occur:

(A) $X_L = X_C$

(B) $V_L = V_C$

(C) $Z = R$ and $V = V_R$

(D) All of the above

63. A conductor 0.2 m long carries a current of 3 amperes at right angle to a magnetic field of 0.5 Tesla. The force acting on the conductor will be

(A) 0.3N

(B) 1.0N

(C) 3.0N

(D) 30N

64. The load current of a dc series motor is 50A, when supplying a full load torque. If the current is reduced to 25A, the torque will be

(A) 25% of full load torque.

(B) 50% of full load torque.

(C) 150% of full load torque.

(D) same as full load torque.

65. The per unit impedance of a circuit element is 0·30. If the base KV and base MVA are halved, then the new value of the per unit impedance of the circuit element will be

(A) 0·30

(B) 0·60

(C) 0·0030

(D) 0·0060

66. Which of the following waves has unity form factor?

(A) Triangular wave

(B) Square wave

(C) Sine wave

(D) None of the above

67. Total inductance of a group of two series connected and unshielded inductance when flux produced by one opposes the flux produced by the other is equal to

(A) $L_1 + L_2$

(B) 2M

(C) $L_1 + L_2 + 2M$

(D) $L_1 + L_2 - 2M$

68. The number of comparators needed in a parallel conversion type 8-bit A to D convertor is

(A) 8

(B) 16

(C) 255

(D) 256

69. The surface integral of electric field intensity gives

(A) net flux emanating out from the surface.

(B) net charge enclosed by the surface.

(C) flux density.

(D) None of the above

70. Stringing chart is used in transmission lines for

(A) designing the tower.

(B) calculating the sag in the conductor.

(C) determining the distance between the conductor.

(D) the design of insulator string.

71. The insulation resistance of a single core cable is 160 MΩ/km. The insulation resistance for 4 km length is

(A) 80 MΩ
(B) 40 MΩ
(C) 120 MΩ
(D) 320 MΩ

72. The full scale input voltage to an ADC is 10 V. The resolution required is 5 mV. The minimum number of bits required for ADC is

(A) 8
(B) 10
(C) 11
(D) 12

73. In a shunt generator the voltage builds up till constrained by

(A) Saturation of iron
(B) Speed limitation
(C) Armature heating
(D) Insulation restrictions

74. The bandwidth of a feedback amplifier

(A) remains unaffected.
(B) increases by the same amount as the gain decreases.
(C) decreases by the same amount as the gain decreases.
(D) decreases by the same amount as the gain increases.

75. Which of the following is not a method of voltage equalization in a string insulator?

(A) Increasing the length of cross arm
(B) Grading of the units
(C) Static shielding
(D) Connecting two discs in parallel

76. A Wheatstone bridge requires a change of 6 ohm in the unknown arm of the bridge to produce a change in deflection of 3 mm of the galvanometer. The sensitivity of the instrument is

(A) 0·75%
(B) 2%
(C) 0·5%
(D) 3%

77. Compensating windings are used in dc generators

(A) to provide path for the circulation of cooling air.
(B) to neutralise the cross magnetising effect of the armature reaction.
(C) mainly to reduce the eddy currents by providing local short circuits.
(D) None of the above

78. In Gauss-Seidel method of power flow problem, the number of iterations may be reduced if the correction in voltage at each bus is multiplied by

(A) Gauss constant
(B) Acceleration constant
(C) Blocking factor
(D) Deceleration constant

79. The presence of ground causes the line capacitance to

(A) increase by about 12%.
(B) decrease by about 12%.
(C) increase by about 0·2%.
(D) None of the above

80. A 200 μH coil has Q of 250 at resonance frequency of 800 kHz. The effective resistance of coil is

(A) 8 ohm
(B) 4 ohm
(C) 2 ohm
(D) 1 ohm

81. Which of the following loads is not responsible for low power factor?

(A) Arc lamps
(B) Incandescent lamp
(C) Fluorescent tubes
(D) Induction motors

82. Which relay is used in protection of long transmission lines?

(A) mho relay
(B) Reactance relay
(C) Impedance relay
(D) None of the above

83. The first commercially used HVDC link was built in

(A) 2006
(B) 1954
(C) 1886
(D) yet to be built

84. Aluminium is now most commonly employed conductor material in transmission lines than copper because

(A) it is more conductive
(B) its tensile strength is more
(C) costlier
(D) it is cheaper and lighter

85. Temperature increase produces the following effect on a transmission line:

(A) Sag and tension of conductor decreases.
(B) Sag and tension of conductor increases.
(C) Sag increases and tension of the conductor decreases.
(D) Sag decreases and tension of the conductor increases.

86. The number of comparisons carried out in 4-bit flash type A/D converter is

(A) 16
(B) 15
(C) 4
(D) 3

87. A short line with R/X ratio 1, the zero regulation is obtained when the power factor of the load is

(A) 0·5
(B) unity
(C) 0 leading
(D) 0·707 leading

88. Two identical stages of amplifiers are cascaded in R-C coupling. If 10 is the midband voltage gain of each stage, then the overall gain of cascade configuration will be

(A) 40 db
(B) 20 db
(C) 100 db
(D) $20 \log_{10} 20$ db

89. Shunt conductance in power transmission is due to

(A) leakage over the poles.
(B) leakage over the insulators.
(C) leakage over the conductors.
(D) leakage between ground and conductors.

90. The voltage that appears across the contacts after the circuit breaker is opened

(A) recovery voltage
(B) arc voltage
(C) break open voltage
(D) surge voltage

91. Pure inductive circuit takes power from the ac line when

(A) applied voltage increases but current decreases.

(B) applied voltage decreases but current increases .

(C) both applied voltage and current decrease.

(D) both applied voltage and current increase.

92. A PMMC type ammeter and a moving iron type ammeter are connected in series in a resistive circuit fed from output of a half wave rectifier voltage source. If the moving iron type reads 5A, the PMMC type instrument is likely to read

(A) Zero

(B) 2·5 A

(C) 3·18 A

(D) 5A

93. Addition of zeros in transfer function causes _____ compensation.

(A) Lag

(B) Lead

(C) Lag Lead

(D) None of the above

94. Corona loss increases when the density of air

(A) increased

(B) decreased

(C) remains uniform

(D) is uniform

95. In a parallel R-C circuit, the supply current always _____ the applied voltage.

(A) leads

(B) lags

(C) remains in phase with

(D) None of the above

96. Two long parallel conductors carry 100 A. If the conductors are separated by 20 mm, the force per metre of length of each conductor will be

(A) 0.1N

(B) 1N

(C) 10N

(D) 100N

97. A long line with no load

(A) generates capacitive reactive power.

(B) generates inductive reactive power.

(C) does not generate any power.

(D) generates both active and reactive power.

98. A conductor of axial length 30 cm carries a current of 100 A and lies at right angles to a magnetic field of strength 0.4 tesla. What is the force in Newtons exerted on it?

(A) 10N

(B) 12N

(C) 1.2N

(D) 0N

99. Creeping occurs in

(A) Energy meter

(B) Voltmeter

(C) Ammeter

(D) Galvanometer

100. _____ for copper is lower as compared to aluminium.

(A) Resistivity

(B) Specific Gravity

(C) Melting Point

(D) All of the above