Test Booklet Series

A

ELECTRICAL ENGINEERING
(OBJECCTIVE TYPE)
PAPER – I

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet

4. This Test Booklet contains 120 items (questions), 60 in PART – A and 60 in PART – B. Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.

5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.

10. Penalty for wrong answers:

THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0.33)** of the marks assigned to that question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happiness to be correct and there will be same penalty as above to that question.

(iii)If a question is left blank, i.e. no answer is given by the candidate, there will be **no penalty** for that question.

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

01. The electric field strength at any point at a distance r from the point charge q located in a homogeneous isotropic medium with dielectric constant ε, is given by

(a) $E = \frac{q\varepsilon^{-1}}{4\pi r^2}\hat{r}$ (b) $E = \oint D da \cos\theta$

(c) $E = \frac{q\varepsilon}{4\pi r^2}\hat{r}$ (d) $E = \frac{q^2}{4\pi\varepsilon r^2}\hat{r}$

Ans: (a)

02. The vector statement of Gauss's law is

(a) $\oint_V D.da = \int_S \sigma dv$ (b) $\int_V D.da = \oint_S \rho dv$

(c) $\iint_S D.da = \int_V \rho^2 dv$ (d) $\oint_S D.da = \int_V \rho dv$

Ans: (d)

03. The unit of magnetic flux density is

(a) gauss (b) tesla (c) bohr (d) weber/sec

Ans: (b)

04. Match List-I with List-II and select the correct answer using the code given below the Lists:

List-I	**List-II**
A. Antiferro magnetic	01. Permanent magnetic dipoles
B. Ferri magnetism	02. Dipoles interact or line up in parallel
C. Diamagnetic	03. Neighbouring magnetic moments are aligned anti parallel with equal magnitudes
D. Ferro magnetic	04. Neighbouring magnetic moments are aligned anti parallel with unequal magnitudes

Codes:

	A	**B**	**C**	**D**		**A**	**B**	**C**	**D**
(a)	4	3	1	2	(b)	2	3	1	4
(c)	4	1	3	2	(d)	2	1	3	4

No Answer

05. Skin depth is the distance from the conductor surface where the field strength has fallen to

(a) π of its strength at the surface (b) e of its strength at the surface

(c) (1/e) of its strength at the surface (d) $(1/\pi e)$ of its strength at the surface

Ans: (c)

06. A signal of 10 V is applied to a 50 Ω coaxial transmission line terminated in 200Ω. The magnitude of the reflected voltage will be
(a) 6 V (b) 10 V (c) 0 V (d) 1 V

Ans: (a)

07. The magnetic flux density created by an infinitely long conductor carrying a current I at a radial distance R is
(a) $\frac{\mu_0 I}{2\pi R}$ (b) $\frac{I}{2\pi R}$ (c) $\frac{\mu_0 I}{2\pi R^3}$ (d) $\frac{4\pi R^2 I}{3}$

Ans: (a)

08. The electric field in the vicinity of two oppositely charged parallel conductors is
(a) radial uniformly
(b) in parallel lines between the two imaginary parallel planes passing through the centres of the two conductors
(c) not uniform and its direction changes from point to point
(d) in parallel circular paths between the two conductors, with the centre of the circles located at the mid-point of a line joining the two centres of the two conductors

Ans: (d)

09. Two charges are placed at a distance apart. Now, if a glass slab is inserted between them, then the force between the charges will
(a) reduce to zero (b) increase (c) decrease (d) not change

Ans: (c)

10. What is the effect of lag compensator on the system bandwidth and the signal-to-noise ratio?
(a) Bandwidth is increased and signal-to-noise ratio is improved
(b) Bandwidth is increased and signal-to-noise ratio is deteriorated
(c) Bandwidth is reduced and signal-to-noise ratio is deteriorated
(d) Bandwidth is reduced and signal-to-noise ratio is improved

Ans: (d)

11. The following point charges are located in air:
+0.008μC at (0, 0) m
+0.05μC at (3, 0) m
-0.009μC at (0, 4) m
The total electric flux over a sphere of 5 m radius with centre (0, 0) is
(a) 0.058μC (b) 0.049μC (c) 0.029μC (d) 0.016μC

Ans: (b)

12. Electric flux through a surface area is the integral of the
(a) normal component of the electric field over the area
(b) parallel component of the electric field over the area
(c) normal component of the magnetic field over the area
(d) parallel component of the magnetic field over the area

Ans: (a)

13. Consider a metallic conductor of length L m and a constant cross sectional area of Am^2. A steady potential difference of V volts is applied between the ends of the conductor. The drift velocity of the free electrons is γ m/s. The mobility of the electrons is defined as u = $\frac{\gamma}{V/L}$ m/s. If the number of free electrons per m^3 is N and each carries a charge of e coulomb, the resistance R of the conductor is

(a) $\frac{L}{NAue}$ ohm (b) $\frac{LN}{Aue}$ ohm (c) $\frac{Lu}{NAe}$ ohm (d) $\frac{Lue}{NA}$ ohm

Ans: (a)

14. The presence of one of the following materials, in iron or steel for use as a magnetic material, tends to reduce the hysteresis loss
(a) Carbon (b) Sulphur (c) Phosphorus (d) Silicon

Ans: (d)

15. The angle between two adjacent asymptotes in a root locus diagram is

(a) $\frac{\pi}{n+m}$ (b) $\frac{2\pi}{n+m}$ (c) $\frac{\pi}{n-m}$ (d) $\frac{2\pi}{n-m}$

Ans: (d)

16. The equation of continuity defines the relation between
(a) electric field and magnetic field
(b) electric field and charge density
(c) flux density and charge density
(d) current density and charge density

Ans: (d)

17. The vector magnetic potential of a particular wave traveling in free space is given by

$$\overline{A} = \overline{a_x} A_x \sin(\omega t - \beta z)$$

where A_X is a constant. The expression for the electric field will be

(a) $-\overline{a_x}\beta A_x \sin(\omega t - \beta z)$ (b) $-\overline{a_y}\beta A_x \sin(\omega t - \beta z)$

(c) $-\overline{a_y}\omega A_x \cos(\omega t - \beta z)$ (d) $-\overline{a_x}\omega A_x \cos(\omega t - \beta z)$

Ans: (d)

18. As a result of reflections from a plane conducting wall, electromagnetic waves acquire an apparent velocity greater than the velocity of light in space. This is called
(a) velocity propagation (b) normal velocity
(c) group velocity (d) phase velocity

Ans: (d)

19. A 75 Ω transmission line is first short-terminated and the minima locations are noted. When the short is replaced by a resistive load R_L, the minima locations are not altered and the VSWR is measured to be 3. The value of R_L is
(a) 25 Ω (b) 50 Ω (c) 225 Ω (d) 250 Ω

Ans: (a)

20. The depth of penetration of a wave in a lossy dielectric increases with increasing
(a) conductivity (b) permeability (c) wavelength (d) permittivity

Ans: (c)

21. Match List-I with List-II and select the correct answer using the code given below the Lists:

List-I	**List-II**
A. Carbon (Diamond)	1. Conducting
B. Silicon	2. Semi-conducting
C. Tin (Grey)	3. Insulating
D. Lead	

Code:

	A	**B**	**C**	**D**		**A**	**B**	**C**	**D**
(a)	3	2	1	1	(b)	1	2	1	3
(c)	3	1	2	1	(d)	1	1	2	3

Ans: (a)

22. It is possible to destroy the super conductivity of a material by applying
(a) a strong magnetic field
(b) a temperature much below the transition temperature
(c) a strong electric field
(d) a pressure below that of the atmosphere

Ans: (a)

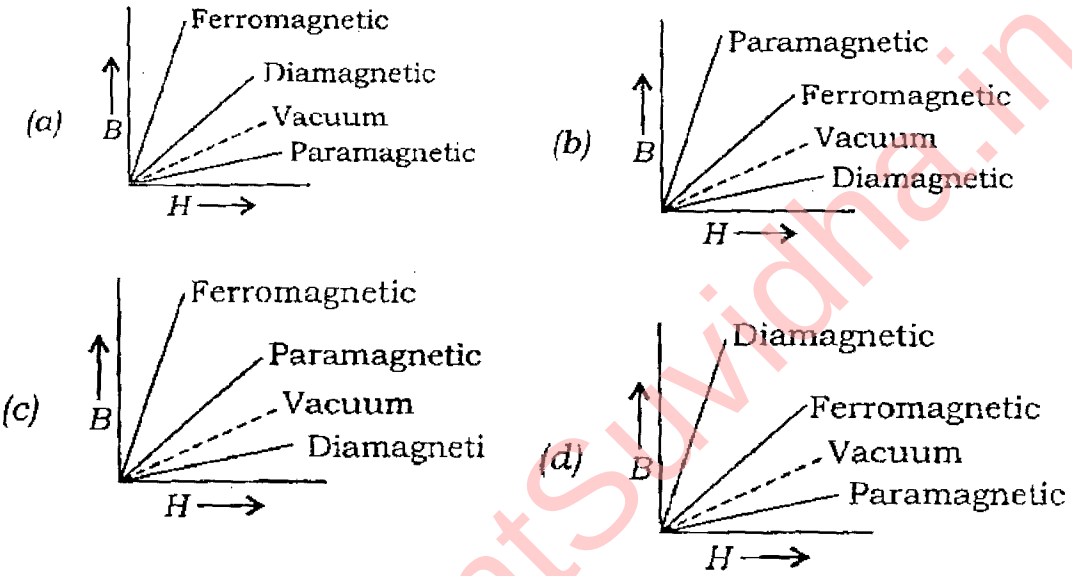
23. Consider the following properties of insulators:
1. Insulation resistance
2. Dielectric breakdown strength
3. Dielectric losses
4. Permittivity

Some of these properties are for DC use and some are for AC use.
The correct combination is

	DC use	AC use
(a)	1, 2 and 3	1, 2 and 4
(b)	1 and 3	1, 2 and 3
(c)	2 and 4	1 and 2
(d)	1 and 2	1, 2, 3 and 4

Ans: (d)

24. The dependence of B (flux density) on H (magnetic field intensity) for different types of materials is



Ans: (c)

25. If a high frequency AC signal, whose r.m.s. value is $\sqrt{2}$V, is applied to a PMMC instrument, then the reading of the instrument will be
(a) 2 V (b) $\sqrt{2}$ V (c) 1 V (d) zero

Ans: (d)

26. The current in a coil changes from 5A to 1A in 0.4 second. The induced voltage is 40 V. The self inductance in henry is
(a) 1 (b) 2 (c) 4 (d) 10

Ans: (c)

27. Which of the following moving particles **cannot** be deflected by magnetic fields?
(a) α-Particles (b) Neutrons (c) Protons (d) Electrons

Ans: (b)

28. High-frequency transformer cores are generally made from
(a) Mu-metal (b) Mone-metal (c) ferrites (d) cobalt

Ans: (c)

29. A coil having 250 turns is connected to a 50 V DC source. If the coil resistance is 10Ω, the m.m.f. (magnetomotive force) developed in AT would be
(a) 500 (b) 1250 (c) 2500 (d) 250

Ans: (b)

30. Match List-I with List-II and select the correct answer using the code given below the Lists:

List_I	**List-II**
A. Electric field	1. Photodiodes
B. Variable	2. Liquid crystal
C. Light energy	3. Hall effect sensor
D. Magnetic field	4. Varistor

Code:

	A	**B**	**C**	**D**		**A**	**B**	**C**	**D**
(a)	2	1	4	3	(b)	3	1	4	2
(c)	2	4	1	3	(d)	3	4	1	2

Ans: (c)

31. A single-phase energy meter having meter constant of 200 rev/kWh is operating on 230V, 50 Hz supply with a load of 10 A, and at unity power factor for three hours continuously. The number of revolutions shown by the meter during this period is
(a) 13800 (b) 1380 (c) 276 (d) 138

Ans: (b)

32. For a series and a parallel circuit, the equivalent total value of certain parameter X is given by

$$X_e = X_1 + X_2 + X_3 + X_4 + \ldots + Xn$$

Where X_i is the *i*th value of the parameter and X_e is the equivalent value, and n is the number of elements. The parameter X can be
(a) resistance (b) current (c) voltage (d) power

Ans: (d)

33. The maximum power will be transferred from a voltage source to a load when
(a) the source impedance is half that of the load impedance
(b) the source impedance is equal to that of the load impedance
(c) the source impedance is twice that of the load impedance
(d) both source and load impedances must be zero

Ans: (b)

34. A 3-phase, 4-wire system supplies power to a balanced star-connected load. The current in each phase is 15A. The current in the neutral wire will be

(a) 15 A
(b) 45 A
(c) 8.66 A
(d) 0 A

Ans: (d)

35. The condition for reciprocity for a two-port transmission network is expressed by

(a) $\begin{vmatrix} A & B \\ C & D \end{vmatrix} = 0$
(b) $\begin{vmatrix} A & D \\ B & C \end{vmatrix} = 1$
(d) $\begin{vmatrix} A & C \\ B & D \end{vmatrix} = 0$
(d) $\begin{vmatrix} A & B \\ C & D \end{vmatrix} = 1$

Ans: (d)

36. A series L-C-R circuit has a resonant frequency f_o, with R = 1Ω, L = 1 H and C = 1 F. If the components' values are tripled, the new resonant frequency will be

(a) $3f_0$
(b) Unaltered
(c) $\frac{f_0}{\sqrt{3}}$
(d) $\frac{f_0}{3}$

Ans: (d)

37. The response y(t) of a linear system to an excitation $x(t) = e^{-3t}u(t)$ is

$$y(t) = (2t+1)e^{-2t}u(t)$$

Poles and zeros will be at

(a) -1, -1 and -2, -2
(b) -2, -2 and -3, -4
(c) -3, -3 and -4, -5
(d) None of the above

Ans: (d)

38. A network has a transfer function

$$H(s) = \frac{V(s)}{I(s)} = \frac{2s+5}{s+2}$$

If the current i(t) is a unit step function, the steady-state value of v(t) is given by

(a) 0
(b) 2.5 A
(c) 2 A
(d) infinity

Ans: (b)

39. The unit impulse response of a system is given as

$$C(t) = -4e^{-t} + 6e^{-2t}$$

The step response of the same system for $t \geq 0$ is

(a) $-3e^{-2t} - 4e^{-t} + 1$ (b) $-3e^{-2t} + 4e^{-t} - 1$

(c) $-3e^{-2t} - 4e^{-t} - 1$ (d) $-3e^{-2t} + 4e^{-t} + 1$

Ans: (b)

40. The current is given by

$$I(s) = \frac{(s+2)(s+4)}{s(s+1)(s+\alpha)}$$

If the steady-state current at $t = \infty$ is 12A, then the value of α and initial value of current will be

(a) 1.5 and 1 A (b) 0.66 and 1 A

(c) 0.33 and 0.5 A (d) 0.25 and 0.5 A

Ans: (b)

41. In a linear network, a 1 Ω resistor consumes a power of 4 W when voltage source of 4 V is applied to the entire circuit, and 16 W when the voltage source is replaced by an 8 V source. The power consumed by the 1 Ω resistor when 12 V is applied will be

(a) 0 W (b) 20 W (c) 36 W (d) 144 W

Ans: (c)

42. Consider the following statements:
Any element connected in

1. series with a voltage source is redundant
2. parallel with a voltage source is redundant
3. series with a current source is redundant
4. parallel with a current source is redundant

The correct statements are

(a) 1 and 3 (b) 2 and 3 (c) 3 and 4 (d) 1 and 2

Ans: (b)

43. Match List-I with List-II and select the correct answer using the code given below the Lists:

List-I	**List-II**
A. Resistance	1. Number of node pairs
B. Inductance	2. Conductance
C. Loop current	3. Capacitance
D. Number of loops	4. Node pair voltage

Code:

	A	**B**	**C**	**D**		**A**	**B**	**C**	**D**
(a)	1	3	4	2	(b)	2	3	4	1
(c)	1	4	3	2	(d)	2	4	3	1

Ans: (b)

44. The lowest and the highest critical frequencies of R-C driving-point impedance are respectively
(a) a zero and a pole (b) a pole and a pole
(c) a zero and a zero (d) a pole and a zero

Ans: (d)

45. In a series resonance circuit, at resonance, selectivity Q is equal to
(a) $\frac{1}{R\sqrt{LC}}$ (b) $\frac{1}{R}\sqrt{\frac{C}{L}}$ (c) $\frac{1}{R}\sqrt{\frac{L}{C}}$ (d) $\frac{1}{R}\sqrt{LC}$

Ans: (c)

46. For an R-L-C series circuit in resonance, the following statement in **not** correct
(a) The current is maximum
(b) The voltage phasors across the capacitance and inductance are unequal
(c) The voltage drops across the resistance is maximum
(d) The voltage drops across the capacitance and inductance are unequal in magnitude

Ans: (d)

47. A coil of resistance 20 Ω and inductance 0.8 H is connected to a 200 V DC supply. The rate of change of current at $t=0^+$ is
(a) 16 A/s (b) 160A/s (c) 250 A/s (d) 4000 A/s

Ans: (c)

48. When a unit impulse voltage is applied to an inductor of 1 H, the energy supplied by the source is
(a) 2 J (b) 1 J (c) $\frac{1}{2}$ J (d) $\frac{1}{4}$ J

Ans: (c)

49. The number of independent KVL and KCL equations for a network with n nodes and l links are respectively
(a) *l* and n (b) *l* and n-1 (c) n-1 and *l* (d) n-1 and *l*-1

Ans: (b)

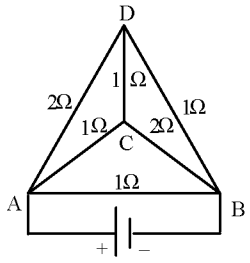
50. The total number of branches in a network is equal to b. The graph of the network has n number of branches. The minimum number of line currents is
(a) b+n (b) b (c) b-n (d) n

Ans: (c)

51. A triangular pyramid, built up of six wires whose resistances are shown in the figure, is fed from a 1 V battery at the terminals A and B. The current through the branch DB is

(a) $\frac{1}{7}$A (b) $\frac{2}{7}$A

(c) $\frac{3}{7}$A (d) $\frac{4}{7}$A



Ans: (c)

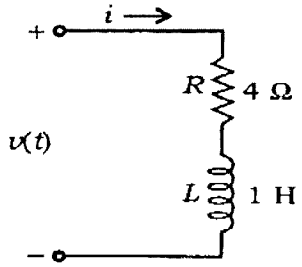
52. Consider an L-R circuit in which a current $i = 5e^{-2t}$ A is flowing. The voltage across the R-L circuit is given by

(a) $20e^{-2t}$ V

(b) $-10e^{-2t}$ V

(c) $10e^{-2t}$ V

(d) $5e^{-2t}$ V



Ans: (c)

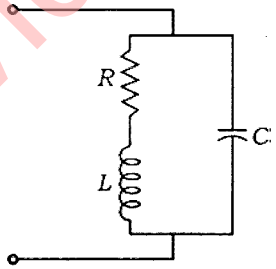
53. The circuit given above is constitute by an iron-cored coil and a capacitor. At resonance, the circuit behaves like

(a) an open circuit

(b) a short circuit

(b) a pure resistor value R

(d) a pure resister of value much higher than R



Ans: (d)

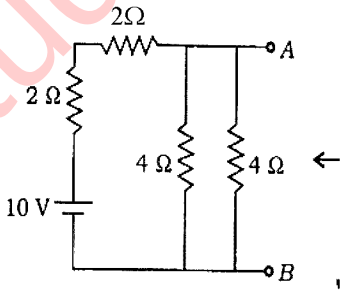
54. The output resistance of the circuit at port AB is

(a) 1 Ω

(b) 1.2 Ω

(c) 1.33 Ω

(d) 1.5 Ω



Ans: (c)

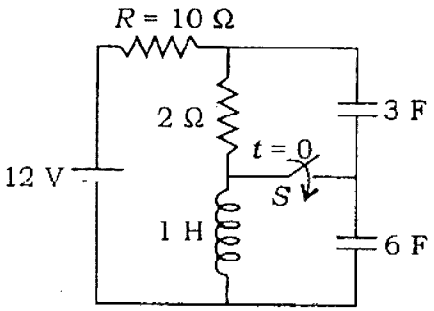
55. The circuit given above is in steady state for a long time with switch S open. The switch is closed at t = 0. The current through R at t = 0 will be

(a) $\frac{1}{3}A$

(b) $\frac{2}{3}A$

(c) 1 A

(d) 2 A



Ans: (c)

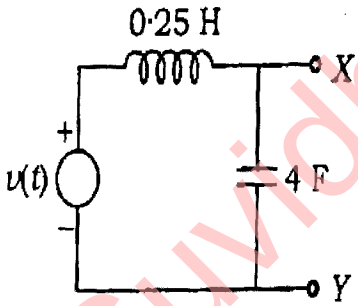
56. The given network will act as an ideal current source with respect to terminals X and Y, if frequency f is

(a) $\frac{1}{\pi}Hz$

(b) $\frac{1}{2\pi}Hz$

(c) $\frac{1}{4\pi}Hz$

(d) $\frac{1}{3\pi}Hz$



Ans: (b)

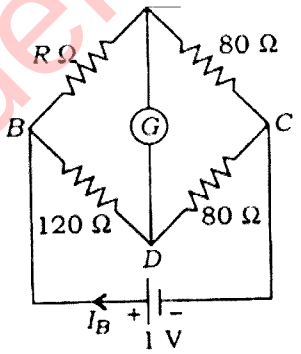
57. In the circuit shown, when the current through the branch AD is zero, the battery current I_B is

(a) 1 mA

(b) 2 mA

(c) 10 mA

(d) 20 mA



Ans: (c)

58. When a steady current is passed through a ballistic galvanometer, then the deflection will be

(a) maximum

(b) zero

(c) twice the normal value as it depends on Hibbert magnetic standard

(d) None of the above

Ans: (b)

59. The measurement of frequency can be carried out with
(a) Owen's bridge
(b) Wien's bridge
(c) Maxwell's inductance-capacitance bridge
(d) Schering's bridge

Ans: (b)

60. An angular deflection type indicating PMMC meter is provided with spring control and
(a) damping by air dashpot
(b) electromagnetic damping in the aluminium former only
(c) electromagnetic damping in the aluminium former and the moving coil as well
(d) no damping

Ans: (b)

61. An advantage of PMMC instrument is that it
(a) is free from friction error
(b) has high torque-to-weight ratio of moving parts
(c) has low torque-to-weight ratio
(d) can be used on both AC and DC

Ans: (b)

62. The following is not essential for the working of an indicating instrument
(a) Deflecting torque (b) Braking torque
(c) Damping torque (d) Controlling torque

Ans: (b)

63. Systematic error of an instrument for measurement can be minimized by
(a) selecting a proper measuring device for the particular application
(b) calibrating the measuring device against a standard device
(c) applying correction factors for change of ambient conditions
(d) carrying out all of the above

Ans: (d)

64. The following material is not used for making a piezoelectric transducer
(a) Rochelle salt (b) Barium titanate
(c) Chlorium sulphide (d) Quartz

Ans: (c)

65. A linear displacement digital transducer uses
(a) BCD code (b) Gray code
(c) hexadecimal code (d) binary code

Ans: (b)

66. An electronic voltmeter gives more accurate readings in high resistance circuits as compared to a non-electronic voltmeter because of its
(a) low meter resistance (b) high kΩ/V rating
(c) high V/kΩ rating (d) high resolution

Ans: (b)

67. By mistake, an ammeter is used as a voltmeter. In all probabilities, it will
(a) give much higher reading (b) give extremely low reading
(c) indicate no reading at all (d) get damaged

Ans: (d)

68. The meter constant of a single-phase energy meter is 500 rev/kWh. It is found that with a load of 5 kW, it makes 40 revolutions in 50 sec. The percentage error is
(a) 5.25% (b)10.5% (c) 15.25% (d) 20%

Ans: (c)

69. A shunt resistance of 25Ω is required for extending the range of an ammeter from 100 μA to 500 μA. The value of internal resistance of this ammeter will be
(a) 25Ω (b) 50Ω (c) 100Ω (d) 1000Ω

Ans: (c)

70. Two resistances R_1= 100 ±10%Ω and R_2 = 300 ± 5% Ω are connected in series. The resulting limiting error of the series combination is
(a) 5Ω (b) 15Ω (c) 25Ω (d) 30Ω

Ans: (c)

71. The pressure in a tank varies from 20 psi to 100 psi. The pressure in the tank is desired to be kept at 50 psi. The full-scale error when the pressure inside the tank is 30 psi will be
(a) 35% (b) 25% (c) 40% (d) 15%

Ans: (b)

72. Which of the following are the objectives of a data acquisition system?
1. It must acquire necessary data at correct speed and time.
2. It must collect and store data.
3. There should be provision for real-time data display.
4. There should be provision for stored data display on request.
(a) 1,2 and 3 only (b) 1, 3 and 4 only (c) 1, 2, 3 and 4 (d) 2, 3 and 4 only

Ans: (c)

73. Analog data acquisition systems are used when
(a) wide bandwidth and low accuracy are required/sufficient
(b) narrow bandwidth and low accuracy are required/sufficient
(c) wide bandwidth and high accuracy are required
(d) narrow bandwidth and high accuracy are required

Ans: (a)

74. Match List I with List-II and select the correct answer using the code given below the Lists:

List I	List II
A. Thermocouple	1. Modulated output
B. Thermistor	2. Resistance changes with pressure
C. Strain gauge	3. Negative temperature coefficient
D. LVDT	4. Constant temperature at one end

Code:

(a)	A	B	C	D
	1	3	2	4
(b)	A	B	C	D
	4	3	2	1
(c)	A	B	C	D
	1	2	3	4
(d)	A	B	C	D
	4	2	3	1

Ans: (b)

75. An LVDT is used to measure 1mm displacement for which a voltmeter of range 0 to 2V through an amplifier having a gain of 500 is connected at the output of the LVDT. If the output of the LVDT is 2mV, then the sensitivity of the instrument will be
(a) 1 V/mm (b) 0.5 V/mm (c) 0.1 V/mm (d) 0.05 V/mm

Ans: (a)

76. The expansion for the acronym LVDT, a transducer used for displacement measurement, is
(a) low voltage displacement transducer
(b) light vision displacement transducer
(c) linear variable displacement transducer
(d) linear variable differential transformer

Ans: (d)

77. When compared with other transducers measuring temperature, a four-lead platinum RTD
1. has better linearity over a wide operating range
2. has better accuracy and precision
3. has better stability at high temperature
4. is inexpensive
Which of these are correct?
(a) 1, 2 and 3 (b) 1,2 and 4 (c) 1, 3 and 4 (d) 2, 3 and 4

Ans: (a)

78. A frequency counter can be used for the measurement of
1. fundamental frequency of input signal
2. time interval between two pulses
Which of these is /are correct?
(a) 1 only (b) 2 only (c) Neither 1 nor 2 (d) Both 1 and 2

Ans: (d)

79. Modern electronic multimeters measure resistance by
(a) taking advantage of an electronic bridge compensator for nulling
(b) forcing a constant current and measuring the voltage across unknown resistance
(c) using a bridge circuit
(d) applying a constant voltage across the unknown resistance and measuring the current through it.

Ans: (b)

80. Guard circuits are used in insulation resistance measurements to
(a) increase the range of resistance values measured
(b) reduce the effect of leakage current on measurement
(c) protect against external electric fields
(d) protect against external magnetic fields

Ans: (b)

81. Match List I with List II and select the correct answer using the code given below the Lists:

List I	List II
A. Mutual inductance	1. Wien bridge
B. High –Q inductance	2. Schering bridge
C. Audio frequency	3. Hay bridge
D. Dielectric loss	4. Heaviside-Campbell bridge

Code:

	A	B	C	D		A	B	C	D
(a)	4	1	3	2	(b)	2	3	1	4
(c)	4	3	1	2	(d)	2	1	3	4

Ans: (c)

82. The preferred methods of measuring low resistance and the resistance of cable insulation are respectively.
(a) V/I method and loss-of-charge method
(b) Kelvin's double bridge and Megger test
(c) Wheatstone bridge and Kelvin's double bridge
(d) potentiometer method and Wheatstone bridge

Ans: (b)

83. A 50 μA meter with an internal resistance of 1 kΩ is to be used as a DC voltmeter of range 50V. Then the voltage multiplying factor n is
(a) 100 (b) 10 (c) 1000 (d) 10000

Ans: (c)

84. The value of resistance R_s to be added in series with an ammeter whose full-scale deflection is of 0.1 mA and internal resistance is of 500Ω, to make it suitable to measure (0-10) V is
(a) 0.02 kΩ (b) 99.5kΩ (c) 500.02Ω (d) 499.98Ω

Ans: (b)

85. The law/principle in mechanical systems, analogous to Kirchhoff's laws in electrical systems, is
(a) first law of motion (b) second law of motion
(c) third law of motion (d) d'Alembert's principle

Ans: (b)

86. A second-order control system exhibits 100% overshoot. Its damping coefficient is
(a) greater than 1 (b) less than 1
(c) equal to 0 (d) equal to 1

Ans: (c)

87. A system has the following transfer function

$$G(s) = \frac{1}{s^2 + 0.1s + 1}$$

If step input is applied to this system, then its setting time within 5% tolerance band will be
(a) 60 sec (B) 40 sec (c) 20 sec (d) 10 sec

Ans: (a)

88. Match List I with List II and select the correct answer using the code given below the Lists:

List I	List II
A. $s^2 + 18s + 64$	1. Underdamped
B. $s^2 + 25$	2. Critically damped
C. $s^2 + 12s + 36$	3. Undamped
D. $s^2 + 8s + 25$	4. Overdamped

Code:

(a)	A	B	C	D
	1	2	3	4
(b)	A	B	C	D
	4	2	3	1
(c)	A	B	C	D
	1	3	2	4
(d)	A	B	C	D
	4	3	2	1

Ans: (d)

89. Match List I with List II and select the correct answer using the code given below the Lists:

List I (Condition)	**List II (Damping constant ξ)**
A. Undamped	1. 0.5
B. Underdamped	2. 2.0
C. Critically damped	3. 0.0
D. Overdamped	4. 1.0

Code:

	A	**B**	**C**	**D**		**A**	**B**	**C**	**D**
(a)	3	4	1	2	(b)	2	4	1	3
(c)	3	1	4	2	(d)	2	1	4	3

Ans: (c)

90. A unity feedback system has a forward path transfer function

$$G(s) = \frac{K}{s(s+8)}$$

Where K is the gain of the system. The value of K, for making this system critically damped, should be

(a) 4 (b) 8 (c) 16 (d) 32

Ans: (c)

91. The impulse response of a linear system is e^{-t}, $t > 0$. The corresponding transfer function is

(a) $\frac{1}{s(s+1)}$ (b) $\frac{1}{s+1}$ (c) $\frac{1}{s}$ (d) $\frac{s}{s+1}$

Ans: (b)

92. The sensitivity of an overall transfer function M(s) of a closed-loop control system with respect to the forward path transfer function G(s) is

(a) $\frac{G}{1+GH}$ (b) $\frac{G}{1-GH}$ (c) $\frac{1}{1-GH}$ (d) $\frac{1}{1+GH}$

Ans: (d)

93. By using feedback in control systems, the sensitivity to parameter variation is improved. This is achieved at the cost of

(a) stability (b) loss of system gain
(c) transient response (d) reliability

Ans: (b)

94. The open-loop transfer function of a control system is $\frac{10}{s+1}$. The steady-state error due to unit step input signal when operated as a unity feedback system is

(a) 10 (b) 0 (c) $\frac{1}{11}$ (d) ∞

Ans: (c)

95. The characteristic equation of a control system is given below:

$F(s) = s^4 + s^3 + 3s^2 + 2s + 5 = 0$

The system is

(a) stable (b) critically stable (c) conditionally stable (d) unstable

Ans: (d)

96. A unit feedback system has an open-loop transfer function as

$$G(s) = \frac{K}{s(1+0.2s)(1+0.05s)}$$

The phase crossover frequency of the Nyquist plot is given by

(a) 5 rad/s (b) 10 rad/s (c) 50 rad/s (d) 100 rad/s

Ans: (b)

97. If the phase margin of a unity feedback control system is zero, then the Nyquist plot of the system passes through

(a) the origin in the GH plane
(b) left-hand side of (-1, *j*0) point in the GH plane
(c) exactly on (-1, *j*0) point in the GH plane
(d) in between origin and (-1, *j*0) point in the GH plane

Ans: (c)

98. A unity feedback control system has G(s) = $\frac{K}{s^2(1+sT)}$

The order and type of the closed-loop system will be

(a) 3 and 1 (b) 2 and 3 (c) 3 and 2 (d) 3 and 3

Ans: (c)

99. Addition of open-loop poles results into which of the following?

(a) Root locus shifts towards imaginary axis

(b) Root locus shifts away from imaginary axis

(c) System stability increases

(d) System becomes less oscillatory

Ans: (a)

100. A unity feedback system has forward transfer function

$$G(s)=\frac{K}{s(s+3)(s+10)}$$

The range of K for the system to be stable is

(a) 0<K<390 (b) 0<K<39 (c) 0<K<3900 (d) None of the above

Ans: (a)

101. The open-loop transfer function of a unity feedback control system is

$$G(s)=\frac{1}{(s+2)^2}$$

The closed-loop transfer function will have poles at

(a) -2, -2 (b) -2, -1 (c) -2, +2 (d) -2±j1

Ans: (d)

102. The open-loop transfer function of the feedback control system is given by

$$G(s)\frac{K}{(s+1)(s+2)(s+3)}$$

The breakaway point in its root locus will be

(a) between -2 and -3 (b) between -1 and -2

(c) between 0 and -1 (d) beyond -3

Ans: (b)

103. The phase-lead compensation is used to

(a) increase rise time and decrease overshoot.

(b) decrease both rise time and overshoot

(c) increase both rise time and overshoot

(d) decrease rise time and increase overshoot

Ans: (b)

104. Given a badly underdamped control system, the type of cascade compensator to be used to improve its damping is
(a) phase-lead (b) phase-lag (c) phase-lag-lead (d) notch filter

Ans: (b)

105. The compensator

$$G_c(s) = \frac{5(1+0.3s)}{1+0.1s}$$

Would provide a maximum phase shift of
(a) 20^0 (b) 30^0 (c) 45^0 (d) 60^0

Ans: (b)

106. The following transfer function represents a phase-lead compensator
(a) $\frac{s+4}{s+6}$ (b) $\frac{4s+2}{6s+1}$ (c) $\frac{s+4}{3s+6}$ (d) $\frac{1}{s}$

Ans: (a)

107. The following relation involving state transition matrix $\phi(t)$ does ***not*** hold true
(a) $\phi(t) = I$ (b) $\phi(t) = \phi[(t)]^{-1}$
(c) $\phi(t_1-t_2) = \phi(t_1-t_0)\phi(t_2-t_0)$ (d) $\phi(t_1+t_2) = \phi(t_1)\,\phi(t_2)$

Ans: (b&c)

108. A non-linear control system is described by the equation

$$\theta + K\sin\theta = 0$$

The type of singular point at (o, o) is
(a) centre (b) focus (c) saddle point (d) None of the above

Ans: (a)

109. In position control systems, the device used for providing rate feedback is called
(a) potentiometer (b) synchro (c) tachogenerator (d) servomotor

Ans: (c)

110. Match List-I with List-II and select the correct answer using the code given below the lists:

List-I (Mechanical translation system)	List-II (Electrical element for analogous system)
A. Mass	1. Resistor
B. Damper	2. Inductor
C. Spring	3. Capacitor
D. Displacement	4. Change

Code:

	A	B	C	D
(a)	4	3	1	2
(b)	2	3	1	4
(c)	4	1	3	2
(d)	2	1	3	4

Ans: (d)

Direction:
Each of the following **ten (10)** items consists of two statements, one labeled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using code given below:
Code:
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is ***not*** the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

111. **Statement (I):**
Polarization is due to the application of an electric field to dielectric materials.
Statement (II):
When the dipoles are created, the dielectric is said to be polarized or in a state of polarization.

Ans: (a)

112. **Statement (I):**
Alnico magnet alloys have the highest energy per unit of cost or volume of any permanent magnetic material commercially available.
Statement (II):
They are very hard and brittle, therefore they cannot be machined and have to be cast and finished by grinding.

Ans: (b)

113. **Statement (I):**
The network function N(s) is denoted with scale factor multiplied with the ratio of zero factors with pole factors.
Statement (II):
When there are *n* zeros and m poles, then the poles at infinity are of multiplicity or degree of (n – m). Similarly when n<m, then the zeros at infinity are of multiplicity or degree of (m – n).

Ans: (b)

114. **Statement (I):**
Under steady-state conditions, a pure inductance acts as a short circuit for direct current.
Statement (II):
The potential drop across an inductance is proportional to the rate of change of current.
Ans: (a)

115. **Statement (I):**
Vibration galvanometer is widely used as detector in bridge measurements.
Statement (II):
Since the damping is very small, the deflection of the moving system is very much greater in neighborhood of resonance than at any other frequency.
Ans: (a)

116. **Statement (I):**
The measurement of voltage magnitude by a cathode-ray oscilloscope is very fast as compared to other methods of measurement.
Statement (II):
Cathode-ray beam travels at the speed of light.
Ans: (d)

117. **Statement (I):**
An electronic voltmeter measures the voltage across a high-value resistor more accurately ad compared with an ordinary multimeter.
Statement (II):
The input impedance of many orders of magnitude higher than that of an ordinary multimeter.
Ans: (a)

118. **Statement (I):**
A hot-wire instrument gives the r.m.s value of the current measured.
Statement (II):
The heat generated is dependent on the average value of the current.
Ans: (c)

119. **Statement (I):**
The rotor of a servomotor is built with resistance so that its X/R ratio become small.
Statement (II):
The servomotor has good accelerating characteristics.

Ans: (a)

120. **Statement (I):**
Control system components for aviation system are designed for 400 Hz.
Statement (II):
The weight of the components reduces when designed for higher frequencies.

Ans: (b)