Engineering Services (Preliminary)
Examination, 2026

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

T.B.C. : RSPV–T–NLEE **Test Booklet Series**

Serial No. 1007969

TEST BOOKLET

A

PAPER—II

(Electrical Engineering)

Time Allowed : Three Hours **Maximum Marks : 300**

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. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.**
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 **150** items (questions). 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.
    (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** 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 happens 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.

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1. Consider the following characteristics regarding ideal operational amplifier :

1. An infinite output impedance and zero input impedance
2. The Op-Amp must have an extremely high inherent voltage gain
3. Zero slew rate

Which of the above characteristics is/are correct?

(a) 1 and 3

(b) 3 only

(c) 2 only

(d) 1 and 2

2. An inverting amplifier using the 741C must have a flat response up to 40 kHz. The gain of the amplifier is 10. What maximum peak-to-peak input signal can be applied without distorting the output?

(a) 0·398 V

(b) 3·98 V

(c) 30·98 V

(d) 0·0398 V

3. Consider the following statements regarding bistable multivibrator :

1. The bistable multivibrator is used as memory elements in shift registers, counters.
2. It is used to generate sine wave by sending regular triggering pulse to the input.
3. It can also be used as a frequency divider.

Which of the above statements is/are correct?

(a) 1 and 3

(b) 3 only

(c) 2 only

(d) 1 and 2

4. What is the percentage of resolution of the eight-bit DAC?

(a) 0·0244%

(b) 0·392%

(c) 0·568%

(d) 0·0148%

5. What is the value of the capacitance to use in a capacitor filter connected to a full-wave rectifier operating at a standard aircraft power frequency of 400 Hz, if the ripple factor is 10% for a load of 500 Ω?

(a) 72·2 μF

(b) 87·6 μF

(c) 25·2 μF

(d) 102·4 μF

6. Match the following Lists regarding *R-C* filter circuit :

List–I *[Component]*	*List–II* *[Output voltage (V_{out})]*
P. Low-pass filter	1. $\frac{1}{RC}\int_0^t V_{in}\,dt$
Q. *R-C* circuit as integrator	2. $V_{in}\frac{\omega RC}{\sqrt{1+(\omega RC)^2}}$
R. High-pass filter	3. $RC\frac{dV_{in}}{dt}$
S. *R-C* circuit as differentiator	4. $V_{in}\frac{1}{\sqrt{1+(\omega RC)^2}}$

Select the correct answer using the code given below.

(a)	P	Q	R	S
	4	3	2	1
(b)	P	Q	R	S
	1	3	2	4
(c)	P	Q	R	S
	4	1	2	3
(d)	P	Q	R	S
	2	1	4	3

7. Match the following Lists :

List–I *(Name of the flag)*	*List–II* *(Bit position in flag register)*
P. Auxiliary carry flag	1. D_0
Q. Parity flag	2. D_2
R. Zero flag	3. D_4
S. Carry flag	4. D_6

Select the correct answer using the code given below.

(a)	P	Q	R	S
	4	3	2	1
(b)	P	Q	R	S
	1	3	2	4
(c)	P	Q	R	S
	2	3	4	1
(d)	P	Q	R	S
	3	2	4	1

8. Match the following Lists regarding interfacing the 8155 memory section :

List–I *(Address lines)*	*List–II* *(Function used for)*
P. A11 to A15	1. Don't Care
Q. A0 to A7	2. Chip Enable
R. A8 to A10	3. Register Select

Select the correct answer using the code given below.

(a)	P	Q	R
	2	3	1
(b)	P	Q	R
	1	3	2
(c)	P	Q	R
	3	1	2
(d)	P	Q	R
	3	2	1

9. The emission current of a diode is 12·5 mA. What is the rms value of shot noise current for a 10 MHz bandwidth?

(a) 18·2 μA

(b) 1·3 μA

(c) 0·2 μA

(d) 2·7 μA

10. A transmitter supplies 10 kW power to an aerial, when unmodulated. What is the power radiated, when modulated to 30%?

(a) 3 kW

(b) 10·45 kW

(c) 14·8 kW

(d) 4 kW

11. Consider the following statements regarding AM versus FM broadcasting :

1. The process of demodulation is complex in AM broadcasting than that of in FM broadcasting.
2. In FM broadcasting, stereophonic transmission is possible.
3. The AM broadcasting system has poor noise performance.

Which of the above statements is/are correct?

(a) 2 and 3

(b) 3 only

(c) 1 only

(d) 1 and 2

12. The signal voltage and noise voltage of a system are 0·923 mV and 0·267 mV respectively. What is the signal-to-noise ratio (SNR) in number?

(a) 3·45

(b) 10·77

(c) 0·29

(d) 11·95

13. Match the following Lists regarding sampling techniques :

List–I (Sampling technique)	*List–II (Principle)*
P. Natural sampling	1. It uses sample-hold principle
Q. Flat-top sampling	2. It uses multiplication
R. Ideal sampling	3. It uses multiplication or chopping principle

Select the correct answer using the code given below.

(a)	P	Q	R
	2	3	1
(b)	P	Q	R
	1	3	2
(c)	P	Q	R
	3	1	2
(d)	P	Q	R
	3	2	1

14. The diode falls under which type of system?

(a) Stable only

(b) Unstable only

(c) Either stable or unstable

(d) Neither stable nor unstable

15. Which of the following properties of convolution system exhibits/exhibit the result of superposition principle for unit impulse response in linear time-invariant systems?

(a) Commutativity only

(b) Distributivity only

(c) Associativity only

(d) Both distributivity and associativity

16. The signal space should be divided as

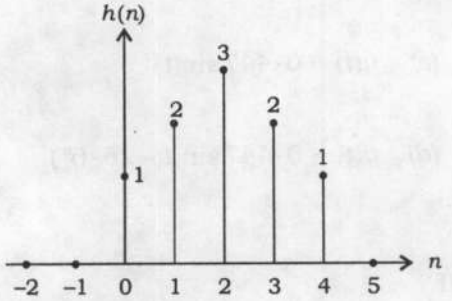
(a) periodic only, whereas the system should be either time scaling or shifting

(b) non-periodic only, whereas the system should be time shifting

(c) either periodic or non-periodic, whereas the system should be either time scaling or shifting

(d) neither periodic nor non-periodic, whereas the system should be time scaling

17. Consider a non-recursive filter with the impulse response $h(n)$ shown in the figure below :



What is the group delay in terms of frequency?

(a) 1

(b) 2

(c) 3

(d) 4

18. If $h(t) = \left[-\frac{2}{3}e^{t} + \frac{2}{3}e^{-2t}\right]u(-t) + \delta(t)$, then the function is

(a) causal and stable

(b) non-causal and stable

(c) causal and unstable

(d) non-causal and unstable

19. The unit impulse response of an LTI system is $h(t) = e^{-t}\sin 2t\,u(t)$. What is the response to $x(t) = \sin(t)$ by using the Laplace transform?

(a) $y(t) = \sin(2t)$

(b) $y(t) = \dfrac{\sin(2t)}{s+1}$

(c) $y(t) = 0{\cdot}447\sin(t)$

(d) $y(t) = 0{\cdot}447\sin(t - 26{\cdot}6°)$

20. If

$x(n) = \{\ldots, 0, 0, \underset{\uparrow}{1}, 1, 1, 1, 1, 1, 1, 1, 0, 0, \ldots\}$

what is the value of $y(n) = x(2n)$?

(a) $y(n) = x(2n) + x(n)$

(b) $y(n) = u(n) - u(n-7)$

(c) $y(n) = u(n) - u(n-4)$

(d) $y(n) = x(n) - x(n-7)$

21. Consider a finite-duration sequence such as $x(n) = \{\underset{\uparrow}{1}, 2, 4, 8, 16\}$. What is the new sequence produced, when it revolves 4 units in the circular shift operation?

(a) $\{\underset{\uparrow}{4}, 8, 16, 1, 2\}$

(b) $\{\underset{\uparrow}{2}, 4, 8, 16, 1\}$

(c) $\{\underset{\uparrow}{1}, 2, 4, 8, 16\}$

(d) $\{\underset{\uparrow}{16}, 1, 2, 4, 8\}$

22. What is the linear convolution response $y(5)$ of the given sequence?

$$x(n) = \begin{cases} \dfrac{2}{\sqrt{3}}\sin\left(\dfrac{\pi n}{3}\right), & 0 \le n \le 5 \\ 0, & \text{elsewhere} \end{cases}$$

and $h(n) = \{\underset{\uparrow}{1}, 2, 3, 2, 1\}$

(a) 0

(b) 9

(c) 14

(d) 28

23. By using the 3-point DFT of the sequence $h(n) = a^{-n}$, $0 \le n \le 2$, for $a = 1{\cdot}369$, what is the relationship between the output sequences?

(a) $H(0) + H(1) + H(2) = 4$

(b) $H(0) + H(1) = H(2)$

(c) $H(1) = H(2)$

(d) $H(2) = H^{*}(1)$

24. If $X(s) = \mathcal{L}\{x(t)\}$, what is the initial value $x(0)$ and the final value $x(\infty)$ respectively, for the given signal $X(s) = \dfrac{7s+6}{s(3s+5)}$, using initial value and final value theorems?

(a) $\dfrac{6}{5}, \dfrac{7}{3}$

(b) $2, \dfrac{7}{3}$

(c) $\dfrac{7}{3}, 2$

(d) $\dfrac{7}{3}, \dfrac{6}{5}$

25. If $X(s) = \mathcal{L}\{x(t)\}$, what is the inverse Laplace transform of the signal $X(s) = \dfrac{2}{s(s+1)(s+2)^2}$?

(a) $x(t) = (0 \cdot 5 - 2e^{-t} + te^{-2t} + 1 \cdot 5e^{-2t})u(t)$

(b) $x(t) = (0 \cdot 5 - 2e^{-t} + te^{-2t} + 2e^{-2t})u(t)$

(c) $x(t) = (0 \cdot 5 - e^{-t} + te^{-2t} + 2e^{-2t})u(t)$

(d) $x(t) = (1 - e^{-t} + te^{-2t})u(t)$

26. What is the DC gain (zero frequency) for a system which has a transfer function of $G(s) = (s+2)/((s+1)(s+3)(s+4))$?

(a) 1/6

(b) 2/3

(c) 1/3

(d) 1/2

27. Match the following Lists :

List–I (Input function)	*List–II (Use)*
P. $\delta(t)$	1. Steady-state error
Q. $u(t)$	2. Transient response
R. $\sin \omega t$	3. Transient response steady-state error
S. $(1/2)t^2u(t)$	4. Transient response modeling steady-state error

Select the correct answer using the code given below.

(a)	P	Q	R	S
	1	2	3	4
(b)	P	Q	R	S
	2	3	4	1
(c)	P	Q	R	S
	4	2	3	1
(d)	P	Q	R	S
	2	4	3	1

28. Consider the following steps regarding multiple-node electrical networks :

1. Replace passive elements' values with their admittance
2. Replace all sources and time variables with their Laplace transform
3. Replace transformed voltage sources with transformed current sources

Which of the above steps are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

29. What is the transfer function $T(s)$ from the state-space input matrix $\dot{x} = [A]x + [B]u$ and output matrix $y = [C]x$, where $T(s) = Y(s)/U(s)$, while $U(s)$ is input and $Y(s)$ is output?

$$\dot{x} = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix} x + \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix} u; \quad y = [1\ 0\ 0]x$$

(a) $T(s) = \dfrac{10(s^2 + 3s + 2)}{s^3 + 3s^2 + 2s + 1}$

(b) $T(s) = \dfrac{10(s^2 + 3s + 2)}{s^3 + 3s^2 + 3s + 1}$

(c) $T(s) = \dfrac{10(s^2 + 3s + 2)}{s^3 + 6s^2 + 5s + 1}$

(d) $T(s) = \dfrac{10(s^2 + 3s + 2)}{s^3 + 2s^2 + 3s + 1}$

30. Consider the following statements regarding first-order systems :

1. The time constant of the system can be described as the time for e^{-at} to decay to 63% of initial value or it is the time taken for the step response to rise to 37% of its final value.
2. Rise time is found to be the time for waveform to go from 0·1 to 0·9 of its final value.
3. Settling time is defined as the time for the response to reach and stay within 4% of its final value.

Which of the above statements is/are ***not*** correct?

(a) 1 only

(b) 2

(c) 3 only

(d) 1 and 3

31. Consider the following statements regarding behavior of second-order underdamped system :

1. The peak time is inversely proportional to the imaginary part of the complex pole.
2. Percent overload is a function of only the damping ratio.
3. Settling time is directly proportional to the real part of the complex pole.

Which of the above statements are correct?

(a) 1 and 3 only

(b) 1, 2 and 3

(c) 1 and 2 only

(d) 2 and 3 only

32. For the closed-loop transfer function given below, what is the system condition based on the number of poles in the left-half plane, the right-half plane and the $j\omega$-axis?

$$T(s) = \frac{200}{s^4 + 6s^3 + 11s^2 + 6s + 200}$$

(a) The system is stable with four poles on the left-half of the plane.

(b) The system is unstable, since it has two right-half plane poles and two left-half plane poles.

(c) The system is marginally stable, since it has two left-half plane poles and two on $j\omega$-axis.

(d) The system is unstable, since it has one right-half plane pole and three left-half plane poles.

33. Consider the following statements regarding stability for linear, time-invariant systems using natural response :

1. A system is marginally stable, if the natural response neither decays nor grows but remains constant or oscillates.
2. A system is unstable, if the natural response approaches infinity as time approaches zero.
3. A system is unstable, if any bounded input yields an unbounded output.

Which of the above statements is/are ***not*** correct?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

34. What are the values of positive constant (K_p), velocity constant (K_v) and acceleration constant (K_a) for a type '0' unity feedback system which has the transfer function $G(s) = \frac{1000(s+8)}{(s+7)(s+9)}$?

(a) $K_p = 0;\ K_v = 0;\ K_a = 127$

(b) $K_p = 0;\ K_v = 0;\ K_a = 0$

(c) $K_p = 0;\ K_v = 127;\ K_a = 127$

(d) $K_p = 127;\ K_v = 0;\ K_a = 0$

35. Consider the following statements regarding properties of a transfer function :

1. The unit of a transfer function is related to the units of the system input and output. A unit is essential.
2. The transfer function can be applied to describe only time-invariant linear systems whose parameters do not change or change only a little during operation.
3. The transfer function is dependent of the input to the system, since the characteristics of the system are modified by the input signal.

Which of the above statements is/are correct?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 2 and 3 only

(d) 2 only

36. Consider the following and give the order of the steps to be followed in performing the block diagram reduction to get the final transfer function for that system :

Step 1 : Combine all serial blocks

Step 2 : Close all inner loops

Step 3 : Combine all parallel blocks

Step 4 : Move summing junctions to the left or right of a block and tie points to the left or right

Select the correct sequence for the above steps.

(a) Step 1, Step 2, Step 3, Step 4

(b) Step 1, Step 3, Step 2, Step 4

(c) Step 3, Step 2, Step 1, Step 4

(d) Step 2, Step 3, Step 1, Step 4

37. Consider the following statements regarding representation of block diagrams through signal flow diagrams :

1. The signal at a node is equal to the sum of all signals transmitted to the node. Sometimes, the transmittance may be positive.
2. The transmittances are simply related to the transfer functions.
3. The transmittances connected to the input/output nodes are both unity; and merely help to make the diagram clearer.

Which of the above statements is/are correct?

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

38. Consider the following statements regarding Nyquist stability criterion :

1. The Nyquist stability criterion is one of the geometric criterion and graphical method in frequency domain.
2. It uses open-loop Nyquist diagram to judge the stability of the closed-loop system.
3. Instead of solving the characteristic roots of the open-loop system, the Nyquist criterion gets the stability of the closed-loop system by means of an open-loop frequency characteristic diagram.

Which of the above statements are correct?

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

39. A transformer on no load has a core loss of 50 W, draws a current of 2 A (rms) and has an induced emf of 230 V (rms). What is the core loss current?

(a) 0·216 A
(b) 1·988 A
(c) 2·328 A
(d) 0·456 A

40. A 500 kVA transformer has an efficiency of 95% at full load and also at 60% of full load; both at unity power factor. Separate out the losses of the transformer.

(a) $P_i = 12 \cdot 42$ kW and $P_c = 18 \cdot 52$ kW
(b) $P_i = 2 \cdot 45$ kW and $P_c = 8 \cdot 35$ kW
(c) $P_i = 8 \cdot 43$ kW and $P_c = 13 \cdot 25$ kW
(d) $P_i = 9 \cdot 87$ kW and $P_c = 16 \cdot 45$ kW

41. Consider the following statements regarding three-phase transformer connections :

1. Delta/delta is economical for small HV transformers.
2. Star/star suits large LV transformers.
3. Star/delta is the most commonly used connection for power systems.

Which of the above statements is/are correct?

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

42. A 240 V/120 V, 12 kVA transformer has full-load unity power factor efficiency of 96·2%. It is connected as an auto-transformer to feed a load at 360 V. What is the auto-transformer rating?

(a) 36 kVA

(b) 18 kVA

(c) 54 kVA

(d) 34·63 kVA

43. The magnetic flux density on the surface of an iron face is 1·6 T, which is a typical saturation level value for ferromagnetic material. What is the force density on the iron face?

(a) $1{\cdot}6 \times 10^6$ N/m^2

(b) $1{\cdot}02 \times 10^6$ N/m^2

(c) $1{\cdot}02 \times 10^7$ N/m^2

(d) $1{\cdot}6 \times 10^7$ N/m^2

44. For a 6-pole DC armature with 16 slots having two coil sides per slot and single-turn coils, what is the commutator pitch (y_c) for a wave winding?

(a) 8 segments

(b) 9 segments

(c) 6 segments

(d) 5 segments

45. Consider the following statements regarding speed control of DC motors :

1. In field control method, speeds higher than the rated speed cannot be obtained.
2. For motors requiring a wide range of speed control, field control method leads to unstable operating conditions or poor commutation.
3. Field control method is not suited to applications needing speed reversal.

Which of the above statements is/are correct?

(a) 2 and 3

(b) 3 only

(c) 1 only

(d) 1 and 2

46. Which one of the following is ***not*** the remedy for reducing cross-magnetizing effect of the armature reaction?

(a) Introducing saturation in the teeth and pole shoe

(b) By chamfering the pole shoes which increases the air gap at the pole tips

(c) By making the field circuit resistance more than the critical value

(d) Compensating the armature reaction mmf by a compensating winding located in the pole shoes

47. The total iron losses in the armature of a DC machine running at 875 rpm are 1100 W. What is the approximate braking torque due to iron losses?

(a) 8 N-m

(b) 16·42 N-m

(c) 8·85 N-m

(d) 12 N-m

48. A 0·5 hp, 6-pole induction motor is excited by a 3-phase, 60 Hz source. If the full-load speed is 1140 rpm, what is the percentage of slip?

(a) 6%

(b) 12%

(c) 5%

(d) 3%

49. A 50 Hz induction motor wound for pole-amplitude modulation has 20 initial poles and the modulating function has 8 poles. At what two speeds will the motor run?

(a) 300 rpm and 214·286 rpm

(b) 400 rpm and 318·524 rpm

(c) 150 rpm and 414·495 rpm

(d) 450 rpm and 115·359 rpm

50. A 3-phase synchronous generator produces an open-circuit line voltage of 6928 V, when the DC exciting current is 50 A. The AC terminals are then short-circuited and the three line currents are found to be 800 A. What is the synchronous reactance per phase?

(a) 138·5 Ω

(b) 8·6 Ω

(c) 80 Ω

(d) 5 Ω

51. Consider the following advantages of hydrogen cooling of alternators in steam power generation :

1. Less noise due to the lower density of hydrogen
2. Ventilation losses (fan power absorbed) are higher by 10%
3. The heat transfer is more than that of air

Which of the above advantages is/are correct?

(a) 2 and 3

(b) 2 only

(c) 1 only

(d) 1 and 3

52. Match the following Lists regarding Surge Impedance Loading (SIL) of AC lines :

List–I *[Conductor configuration and line voltage]*	*List–II* *[SIL (MW)]*
P. Quad Bersimis—400 kV	1. 647
Q. Twin Moose—400 kV	2. 605
R. Quad Zebra—400 kV	3. 691
S. Triple Snowbird—400 kV	4. 515

Select the correct answer using the code given below.

(a)	P	Q	R	S
	3	4	1	2
(b)	P	Q	R	S
	2	1	4	3
(c)	P	Q	R	S
	1	4	2	3
(d)	P	Q	R	S
	4	3	2	1

53. If d is the distance between the conductors and e is the Euler's number, then the maximum critical disruptive voltage occurs when the radius (r) of the conductors is

(a) $d \times e$

(b) $d/(1-e)$

(c) d/e

(d) $d/(1+e)$

54. Match the following Lists regarding cable conductors :

List–I *(Property)*	*List–II* *(Value)*
P. Specific gravity of copper	1. 15 kg/mm^2
Q. Ultimate tensile strength of copper	2. 8·890
R. Specific gravity of aluminium	3. 40 kg/mm^2
S. Ultimate tensile strength of aluminium	4. 2·71

Select the correct answer using the code given below.

(a)	P	Q	R	S
	3	4	1	2
(b)	P	Q	R	S
	2	3	4	1
(c)	P	Q	R	S
	1	3	4	2
(d)	P	Q	R	S
	4	1	2	3

55. Match the following Lists regarding percentage distribution of faults in various elements of a power system :

List–I (Element)	*List–II (% of total faults)*
P. Overhead lines	1. 10
Q. Underground cables	2. 50
R. Transformers	3. 7
S. Generators	4. 9

Select the correct answer using the code given below.

(a) P Q R S
3 4 1 2

(b) P Q R S
2 1 4 3

(c) P Q R S
2 4 1 3

(d) P Q R S
2 3 4 1

56. For a 735 kV line with a fault current of 4 kA, what is the arc resistance? (Assume no resistance in the ground return path)

(a) 4 Ω

(b) 8 Ω

(c) 183·75 Ω

(d) 0·183 Ω

57. Consider the following statements regarding static relays compared with electromechanical relays :

1. In static relays, frequent operations cause deterioration.
2. In static relays, there is a quick resetting and absence of overshoot.
3. Static relays are sensitive to voltage transients.

Which of the above statements is/are correct?

(a) 2 and 3

(b) 2 only

(c) 1 only

(d) 1 and 3

58. What is the maximum value of restriking voltage across the contacts of the circuit breaker in a 132 kV system?

(a) 107·78 kV

(b) 215·56 kV

(c) 93·35 kV

(d) 186·64 kV

59. Consider the following statements regarding radial distribution system :

1. Distributor far away from the substation is highly loaded.
2. Severe voltage variation to the consumers nearest to the substation is due to load variations.
3. Consumers are dependent on a single feeder and a single distributor, and a fault on either of them causes interruption of supply to all the consumers away from the fault.

Which of the above statements is/are correct?

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

60. Match the following Lists regarding bus classifications :

List–I (Bus type)	*List–II (Quantities to be obtained)*
P. Generator bus	1. Real power, reactive power
Q. Load bus	2. Reactive power, phase angle
R. Slack bus	3. Voltage magnitude, phase angle

Select the correct answer using the code given below.

(a)	P	Q	R
	2	3	1
(b)	P	Q	R
	3	2	1
(c)	P	Q	R
	2	1	3
(d)	P	Q	R
	1	3	2

61. Consider the following statements with respect to the change in torque angle whenever a disturbance occurs :

1. There is no change in torque angle when the speed of the rotor is the synchronous speed.
2. The angle decreases in case of a motor, if $P_s > P_e$, i.e., the mechanical output is more than the electrical input and the speed goes down.
3. The angle increases, if the speed is more than the synchronous speed.

Which of the above statements is/are correct?

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

62. Which one of the following is ***not*** a feature of ideal control system for an HVDC converter?

(a) Control should be such that it should require less reactive power.
(b) The DC current is constant, i.e., ripple-free.
(c) Under steady-state conditions, the valve must be fired symmetrically.
(d) There should have continuous operating range from full rectification to full inversion.

63. Consider the following statements regarding Static Synchronous Compensator (STATCOM) :

1. It is insensitive to transmission system harmonics.
2. It has difficulty in operating with a very weak AC system.
3. It can be used for small amount of energy storage.

Which of the above statements is/are correct?

(a) 2 and 3

(b) 3 only

(c) 1 only

(d) 1 and 3

64. A diode circuit consists of a diode in series with switch (S_1), resistance ($R = 44\ \Omega$) and capacitance ($C = 0 \cdot 1\ \mu F$). The capacitor has an initial voltage $V_{C0} = V_C(t = 0) = 220$ V. If switch S_1 is closed at $t = 0$, what is the energy dissipated in the resistor R?

(a) 3·86 mJ

(b) 5 mJ

(c) 139·64 mJ

(d) 2·42 mJ

65. Which of the following is ***not*** a limitation of MOSFET?

(a) High on-state drop, as high as 10 V

(b) Unipolar voltage device

(c) Slower switching speed

(d) Lower off-state voltage capability

66. Two BJTs are connected in parallel to share the total current 25 A. The collector-to-emitter voltage of T_1 and T_2 are 1·5 V and 1·75 V respectively. What is the difference in emitter current sharing by the two transistors, when the current-sharing series resistances are $R_{E1} = 0 \cdot 25\ \Omega$ and $R_{E2} = 0 \cdot 35\ \Omega$?

(a) 0·5 A

(b) 5 A

(c) 0·25 A

(d) 2·5 A

67. The typical upper ratings of power transistor (MOSFET) are

(a) 600 V/40 A

(b) 800 V/40 A

(c) 1000 V/50 A

(d) 1200 V/50 A

68. The firing frequency of relaxation oscillator is varied by changing the value of charging resistance R. What are the maximum and minimum values of R? (Assume $\eta = 0 \cdot 65$, $I_p = 0 \cdot 65$ mA, $V_p = 12$ V, $I_v = 2 \cdot 0$ mA, $V_v = 1 \cdot 5$ V, $V_{BB} = 20$ V and $C = 0 \cdot 047$ μF)

(a) $R_{min} = 9 \cdot 25$ kΩ and $R_{max} = 12 \cdot 3076$ kΩ

(b) $R_{min} = 835$ Ω and $R_{max} = 4 \cdot 5$ kΩ

(c) $R_{min} = 425$ Ω and $R_{max} = 18 \cdot 2469$ kΩ

(d) $R_{min} = 11 \cdot 86$ kΩ and $R_{max} = 19 \cdot 2751$ kΩ

69. The capacitance (C_{J2}) value of reverse-biased junction $J2$ of a thyristor is independent of off-state voltage. The limit value of the charging current to turn the thyristor is about 15 mA. If the critical value of dv/dt is 750 V/μs, what is the value of the junction capacitance (C_{J2})?

(a) 200 pF

(b) 200 μF

(c) 50 pF

(d) 50 μF

70. A single-phase, half-wave controlled rectifier with R load is supplied from a 230 V, 50 Hz AC source. When the average DC output voltage is 50% of maximum possible average DC output voltage, what are the firing angle of thyristor and average DC output voltage respectively?

(a) 45° and 37·32 V

(b) 90° and 36·61 V

(c) 90° and 51·78 V

(d) 45° and 26·39 V

71. A single-phase semi-converter is supplied by 200 V, 50 Hz and it is connected with an R-L-E load, where $R = 15$ Ω, $E = 80$ V and L is very large so that the load current is ripple-free. What is the average output current at $\alpha = 90°$?

(a) 5·58 A

(b) 3·95 A

(c) 0·66 A

(d) 0·24 A

72. A step-down chopper has a load resistance of 20 Ω and input DC voltage is 200 V. When the chopper switch is 'on', the voltage across semiconductor switch is 2 V. If the chopping frequency is 1·5 kHz and duty ratio is 40%, what is the average DC output voltage?

(a) 40 V

(b) 80 V

(c) 39·6 V

(d) 174·4 V

73. What is the expression for distortion factor (DF) in inverters?

(a) $\text{DF} = \dfrac{\left[\Sigma_{n=2,3,4,5,\ldots}^{\infty} \left(\dfrac{V_n}{n^2}\right)^2\right]^{\frac{1}{2}}}{V_1}$

(b) $\text{DF} = \dfrac{\left[\Sigma_{n=2,3,4,5,\ldots}^{\infty} \left(\dfrac{V_n}{n^2}\right)\right]^{\frac{1}{2}}}{V_1}$

(c) $\text{DF} = \dfrac{\left[\Sigma_{n=2,3,4,5,\ldots}^{\infty} \left(\dfrac{V_n}{n}\right)^2\right]^{\frac{1}{2}}}{V_1}$

(d) $\text{DF} = \dfrac{\left[\Sigma_{n=2,3,4,5,\ldots}^{\infty} \left(\dfrac{V_n}{n}\right)\right]^{\frac{1}{2}}}{V_1}$

74. A separately excited DC motor is controlled by a single-phase full converter which is supplied from 440 V, 50 Hz AC supply. If the field circuit is fed through a single-phase full converter with 0° firing angle, the delay angle of armature converter is 30° and load current is 20 A, what is the field current? (Assume that the armature resistance $R_a = 0 \cdot 5\ \Omega$, field resistance $R_f = 140\ \Omega$, and the current waveforms are ripple-free)

(a) 2·83 A

(b) 20 A

(c) 20·19 A

(d) 0·79 A

75. Consider the following statements regarding AC drives :

1. AC drives require simple control algorithms than DC drives.
2. Power converters used in AC drives are relatively simple and less expensive.
3. VSI, CSI, AC voltage controllers, PWM inverters are used in variable speed induction motor drives.

Which of the above statements is/are correct?

(a) 2 and 3

(b) 3 only

(c) 1 only

(d) 1 and 3

76. A box contains 10 screws, three of which are defective. If two screws are drawn at random without replacement, then what is the probability that neither of the two screws is defective?

(a) 49/100

(b) 14/30

(c) 9/10

(d) 2/3

77. If the random variable X, which is the sum of the two numbers of two fair dice turned up, is discrete, then what is the probability of sum of at least 4 and at most 8?

(a) 26/36

(b) 1/6

(c) 23/36

(d) 1/12

78. A bag contains 7 green and 5 yellow balls. Two balls are selected at random, one at a time. What is the probability that the two balls are of different colours, if the selection is made with replacement?

(a) 5/12

(b) 37/72

(c) 5/72

(d) 35/72

79. If the events A and B are such that $P(A) = 0 \cdot 6$, $P(B) = 0 \cdot 2$ and $P(A \cup B) = 0 \cdot 7$, then $P(B|A)$ is

(a) 1/4

(b) 1/6

(c) 2/3

(d) 1/7

80. If $X \sim$ Binomial $(16, \frac{1}{2})$, then what is the variance of the random variable?

(a) 8

(b) 4

(c) 2

(d) 6

81. If $X \sim N(15, 6 \cdot 25)$, then what is the value of X, which is $1 \cdot 2$ standard deviations below the mean?

(a) 12

(b) 15

(c) 16

(d) 14

82. If the height h in metres of a swing above the ground at time t seconds is given by $h = 2 - 1 \cdot 5\sin t$ for $0 < t < 3$, then the maximum height of the swing is

(a) 4 m

(b) 1·79 m

(c) 2 m

(d) 6 m

83. Consider the following statements regarding rank in terms of column vectors :

1. The rank r of a matrix A equals the maximum number of linearly independent column vectors of A.
2. The matrix A and its transpose A^T have the same rank.
3. Consider p vectors each having n components; if $n < p$, then these vectors are linearly independent.

Which of the above statements is/are ***not*** correct?

(a) 1 and 2

(b) 1 and 3

(c) 2 and 3

(d) 3 only

84. The eigenvector $\mathbf{X}_i$ of the $n \times n$ matrix $\mathbf{A}$, corresponding to the eigenvalues $\lambda = \lambda_i$, is a solution of the homogeneous equation, if

(a) $(\mathbf{A} - \lambda_i \mathbf{I})\mathbf{X}_i = 0$

(b) $\mathbf{A} - \lambda_i \mathbf{I} = 0$

(c) $(\mathbf{A} + \lambda_i \mathbf{I})\mathbf{X}_i = 1$

(d) $\mathbf{A} - \lambda_i \mathbf{I} = 1$

85. What is the value of the Fourier coefficient a_0 for the function given below?

$$f(x) = \begin{cases} \sin 2x, & -\pi < x < \dfrac{-\pi}{2} \\ 0, & \dfrac{-\pi}{2} \le x \le 0 \\ \sin 2x, & 0 < x \le \pi \end{cases}$$

(a) $1/(2\pi)$

(b) $1/\pi$

(c) $3/(4\pi)$

(d) $2/\pi$

86. The straight line $\mathbf{r}(t) = at\mathbf{i} + bt\mathbf{j} + ct\mathbf{k} + \mathbf{C}$, with a, b and c as scalar constants and $\mathbf{C}$ as a constant vector, has

(a) a finite radius of curvature at every point

(b) zero radius of curvature at every point

(c) an infinite radius of curvature at every point

(d) an infinite radius of curvature at a single point

87. Consider the following statements regarding properties of eigenvalues :

1. Any square matrix A and its transpose A^T have the same eigenvalues.
2. The eigenvalues of a triangular matrix are just the diagonal elements of the matrix.
3. The sum of the eigenvalues of a matrix is the product of the elements of the principal diagonal.

Which of the above statements are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

88. Let r be the rank for the coefficient matrix A of the system of homogeneous linear equations having m number of equations and n number of variables.

1. If $r < n$, then the equations have $(n - r)$ linearly independent solutions.
2. If $m < n$, the number of solutions is finite.
3. If $m = n$, then such solution is non-trivial solution.

Which of the above statements is/are ***not*** correct?

(a) 1 and 2

(b) 2 only

(c) 1 only

(d) 2 and 3

89. Consider the following statements regarding atomic bonds :

1. If two ions with same ionization potential form a bond, then this bond will most probably be ionic.
2. With the increase in the difference of the ionization potentials, the bond will be more and more ionic.
3. If the atom or molecule has completely filled outer shell, then the bonding between the atoms or molecules will be a primary bond at the time of solidification.

Which of the above statements is/are correct?

(a) 1 and 2

(b) 2 only

(c) 3 only

(d) 2 and 3

90. Match the following Lists :

List–I (Metal)	*List–II (Resistivity)*
P. Li	1. $4{\cdot}34 \times 10^{-8}$ Ω-m
Q. Na	2. $1{\cdot}56 \times 10^{-8}$ Ω-m
R. Cu	3. $8{\cdot}33 \times 10^{-8}$ Ω-m
S. Ag	4. $1{\cdot}47 \times 10^{-8}$ Ω-m

Select the correct answer using the code given below.

(a)	P	Q	R	S
	3	2	4	1
(b)	P	Q	R	S
	3	1	4	2
(c)	P	Q	R	S
	3	1	2	4
(d)	P	Q	R	S
	3	2	1	4

91. What is the drift velocity of electrons knowing that in metals, the free electron concentration is about $n_0 = 10^{28}$ electrons/m^3? (Take maximum admitted value of the density of electric current for metals as $J = 10^7$ A/m^2 and electrical charge of the electron as $q_0 = 1 \cdot 602 \times 10^{-19}$ C)

(a) $1 \cdot 6 \times 10^{-3}$ m/s

(b) $6 \cdot 24 \times 10^{-22}$ m/s

(c) $1 \cdot 6 \times 10^{-22}$ m/s

(d) $6 \cdot 24 \times 10^{-3}$ m/s

92. Which one of the following is generated by the supplementary (precession) movements of the conduction electrons that appear when the material is introduced in a magnetic field?

(a) Langevin diamagnetism

(b) Landau diamagnetism

(c) Lorentz diamagnetism

(d) Larmor diamagnetism

93. The cermet of Au/SiO is obtained by

(a) the deposition on glass support and consists in conductive particles of gold speeded in amorphous matrix of SiO_2

(b) transforming the silicon monoxide at the deposition in a reactive component (Si) and in an insulating one (SiO_2)

(c) the mixture of α-Cr, Cr_3Si and SiO_2 amorphous

(d) the expansion of both non-conductive and conductive zones of a reactive component (Si)

94. Match the following Lists :

List–I (Class of the material)	*List–II (Limiting working temperature)*
P. A	1. 120 °C
Q. E	2. 180 °C
R. H	3. 90 °C
S. Y	4. 105 °C

Select the correct answer using the code given below.

	P	Q	R	S
(a)	3	2	4	1
(b)	4	1	3	2
(c)	3	1	2	4
(d)	4	1	2	3

95. A transformer core is wound with a coil carrying an alternating current at a frequency of 50 Hz. The hysteresis loop has an area of 70000 units, when the axes are drawn in units of 10^{-4} Wb-m^{-2} and 10^2 A-m^{-1}. What is the hysteresis loss by assuming the magnetization to be uniform throughout the core volume of 0·02 m^3?

(a) 350 W

(b) 700 W

(c) 3500 W

(d) 7000 W

96. L is measured value of inductance with magnetic core, L_0 is measured value of inductance without magnetic core, μ_0 is magnetic permeability of free space, h is height of the material under test, c is outer diameter of the material under test, d is inner diameter of the material under test. What is the formula for relative magnetic permeability (μ_r)?

(a) $\mu_r = \dfrac{\mu_0}{2\pi} \dfrac{L - L_0}{h \ln\left(\dfrac{c}{d}\right)}$

(b) $\mu_r = \dfrac{L - L_0}{\mu_0} \dfrac{2\pi}{h \ln\left(\dfrac{c}{d}\right)}$

(c) $\mu_r = \dfrac{\mu_0}{2\pi} \dfrac{L - L_0}{h \ln\left(\dfrac{d}{c}\right)}$

(d) $\mu_r = \dfrac{L - L_0}{\mu_0} \dfrac{2\pi}{h \ln\left(\dfrac{d}{c}\right)}$

97. Consider the following statements regarding ferrites :

1. Ferrites are linear materials and present hysteresis cycle.
2. The values of saturation induction and remanent induction are lower.
3. Magnetic permeability is lower and more sensitive at the action of external magnetic fields.

Which of the above statements is/are correct?

(a) 1 and 2

(b) 2 only

(c) 3 only

(d) 2 and 3

98. What is the conductivity of copper at 300 K, if the collision time τ for electron scattering is 2×10^{-14} s at this temperature? (Take the number of free electrons per m^3 of copper as $8{\cdot}5 \times 10^{28}$, electron charge as $1{\cdot}602 \times 10^{-19}$ C and mass of free electron as $9{\cdot}1 \times 10^{-31}$ kg)

(a) $4{\cdot}8 \times 10^{7}$ ohm^{-1}-m^{-1}

(b) 6×10^{-11} ohm^{-1}-m^{-1}

(c) $4{\cdot}8 \times 10^{-17}$ ohm^{-1}-m^{-1}

(d) 6×10^{7} ohm^{-1}-m^{-1}

99. Match the following Lists :

List–I (Material)	*List–II (Density)*
P. Silver	1. $2{\cdot}70 \times 10^{3}$ kg-m^{-3}
Q. Copper	2. $8{\cdot}96 \times 10^{3}$ kg-m^{-3}
R. Gold	3. $10{\cdot}49 \times 10^{3}$ kg-m^{-3}
S. Aluminium	4. $19{\cdot}32 \times 10^{3}$ kg-m^{-3}

Select the correct answer using the code given below.

	P	Q	R	S
(a)	3	2	1	4
(b)	4	1	3	2
(c)	3	2	4	1
(d)	4	1	2	3

100. The resistivity of pure copper at room temperature is $1{\cdot}8 \times 10^{-8}$ ohm-m. The resistivity of Cu-4% Ni alloy at room temperature is $7{\cdot}0 \times 10^{-8}$ ohm-m. What is the resistivity due to impurity scattering by 1% of nickel in the copper lattice?

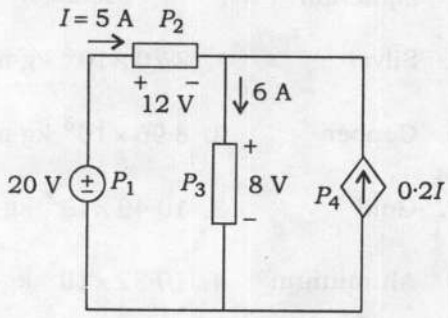
(a) $2{\cdot}2 \times 10^{-8}$ ohm-m

(b) $6{\cdot}5 \times 10^{-8}$ ohm-m

(c) $0{\cdot}2 \times 10^{-8}$ ohm-m

(d) $1{\cdot}3 \times 10^{-8}$ ohm-m

101. What is the power supplied by each element in the circuit shown below?



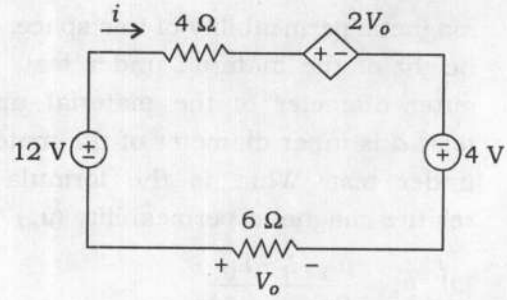
(a) $P_1 = -100$ W; $P_2 = 60$ W; $P_3 = -48$ W; $P_4 = -8$ W

(b) $P_1 = 100$ W; $P_2 = -60$ W; $P_3 = -48$ W; $P_4 = 8$ W

(c) $P_1 = -100$ W; $P_2 = -60$ W; $P_3 = 48$ W; $P_4 = -8$ W

(d) $P_1 = -100$ W; $P_2 = 60$ W; $P_3 = 48$ W; $P_4 = -8$ W

102. What are V_o and i respectively in the circuit shown below?



(a) +48 V, –8 A

(b) +24 V, –4 A

(c) –48 V, +8 A

(d) –24 V, +4 A

103. The electron beam in a TV picture tube carries 10^{15} electrons per second. What is the voltage V_0 needed to accelerate the electron beam to achieve 4 W?

(a) 10 kV

(b) 15 kV

(c) 30 kV

(d) 25 kV

104. Consider the following statements regarding network theorems :

1. With independent sources, superposition theorem can be used only when the control functions are external to the network containing the sources, so that the controls are unchanged as the sources act one at a time.
2. A linear, active, resistive network, which contains one or more voltage or current sources, can be replaced by a single voltage source and a series resistance or by a single current source and a parallel resistance. The voltage is called the Thévenin equivalent voltage and the current is Norton current.
3. The two resistances are the same in both Thévenin's and Norton's theorems which are obtained by deactivating all the sources.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) 1 and 2

(d) 2 and 3

105. A 10-ohm resistor has a current of $i = 2 \cdot 5 \sin \omega t$ (A). What are the values of voltage and power respectively over one cycle of $\omega = 500$ rad/s?

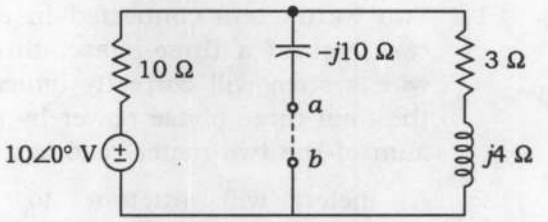
(a) $25 \sin \omega t$ (V); $62 \cdot 5 \sin^2 \omega t$ (W)

(b) $250 \sin \omega t$ (V); $625 \sin^2 \omega t$ (W)

(c) $2 \cdot 5 \sin \omega t$ (V); $62 \cdot 5 \sin^2 \omega t$ (W)

(d) $25 \sin \omega t$ (V); $625 \sin^2 \omega t$ (W)

106. For the network given below, what are the Norton's current and Thévenin's voltage at the terminals a and b?



(a) $I_{ab} = \left[\dfrac{10\angle 0^\circ}{10 + \dfrac{(-j10)(3-j4)}{3+j6}}\right]\left(\dfrac{3-j4}{3+j6}\right)$ A

and $V_{ab} = \dfrac{3-j4}{13+j4}(10\angle 0^\circ)$ V

(b) $I_{ab} = \left[\dfrac{10\angle 0^\circ}{10 + \dfrac{(-j10)(3+j4)}{3+j6}}\right]\left(\dfrac{3-j4}{3+j6}\right)$ A

and $V_{ab} = \dfrac{3-j4}{13+j4}(10\angle 0^\circ)$ V

(c) $I_{ab} = \left[\dfrac{10\angle 0^\circ}{10 + \dfrac{(-j10)(3-j4)}{3-j6}}\right]\left(\dfrac{3-j4}{3-j6}\right)$ A

and $V_{ab} = \dfrac{3+j4}{13-j14}(10\angle 0^\circ)$ V

(d) $I_{ab} = \left[\dfrac{10\angle 0^\circ}{10 + \dfrac{(-j10)(3+j4)}{3-j6}}\right]\left(\dfrac{3+j4}{3-j6}\right)$ A

and $V_{ab} = \dfrac{3+j4}{13+j4}(10\angle 0^\circ)$ V

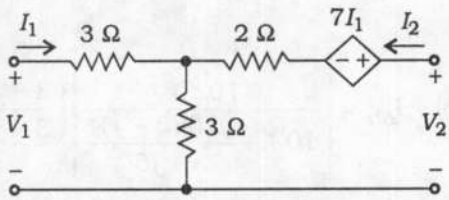
107. Consider the following statements regarding power measurement by two-wattmeter method :

1. Two wattmeters connected in any two lines of a three-phase, three-wire system will correctly indicate the total three-phase power by the sum of the two meter readings.
2. A meter will attempt to go downscale if the phase angle between the voltage and current exceeds 180°.
3. In practical case, the balanced load is usually known to be inductive ($\theta > 0°$).

Which of the above statements is/are correct?

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

108. What are the *Z*-parameters for the network given below?



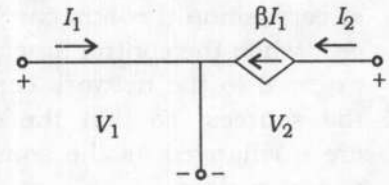
(a) $Z_{11} = 6\,;\ Z_{12} = 3\,;$
$Z_{21} = 10\,;\ Z_{22} = 5$

(b) $Z_{11} = 5\,;\ Z_{12} = 10\,;$
$Z_{21} = 3\,;\ Z_{22} = 6$

(c) $Z_{11} = 6\,;\ Z_{12} = 10\,;$
$Z_{21} = 10\,;\ Z_{22} = 5$

(d) $Z_{11} = 6\,;\ Z_{12} = 3\,;$
$Z_{21} = 3\,;\ Z_{22} = 5$

109. The simplified model of a bipolar junction transistor for small signals is shown in the figure below :



What are the *h*-parameters?

(a) $h_{11} = h_{22} = h_{21} = 0$ and $h_{12} = \beta$
(b) $h_{22} = h_{12} = h_{21} = 0$ and $h_{11} = \beta$
(c) $h_{11} = h_{12} = h_{22} = 0$ and $h_{21} = \beta$
(d) $h_{11} = h_{12} = h_{21} = 0$ and $h_{22} = \beta$

110. Which one of the following statements is ***not*** correct regarding mutual inductance and transformers?

(a) When the assumed currents both enter or both leave a pair of coupled coils by the dotted terminals, the signs on the *M*-terms will be the same as the signs on the *L*-terms.
(b) When one current enters by a dotted terminal while the other leaves by a dotted terminal, the signs on the *M*-terms will be opposite to the signs on the *L*-terms.
(c) The term 'close coupling' is used to describe the case where most of the flux links the coils, either by way of a magnetic core to contain the flux or by interleaving the turns of the coils directly over one another. Coils placed side-by-side without a core are loosely coupled and have correspondingly high values of *k*.
(d) If all the flux links the coil without any leakage flux, then $k = 1$. On the other extreme, the coil axes may be oriented such that no flux from one can induce a voltage in the other, which results in $k = 0$.

111. Consider the following statements regarding factors affecting the capacitance :

1. The area of the plates is directly proportional to the charge; the larger the plate area, the more electric charges that can be stored.
2. The longer the distance between the two plates, the stronger the produced electric field that will increase the ability to store charges. Therefore, the distance between the two plates is directly proportional to the capacitance.
3. Different insulating materials will have different impacts on the capacitance. The dielectric constant is directly proportional to the capacitance.

Which of the above statements is/are correct?

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

112. Which of the following is/are ***not*** discharging equation/equations for an *R-C* circuit?

1. Capacitor voltage $v_C = V_0 e^{-\frac{t}{RC}}$
2. Resistor voltage $v_R = Ee^{-\frac{t}{RC}}$
3. Discharging current $i = \frac{V_0}{R} e^{-\frac{t}{RC}}$

Select the correct answer using the code given below.

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

113. Match the following Lists regarding time constant with capacitor discharging voltage :

List–I (Time constant)	*List–II (Capacitor discharging voltage)*
P. 1τ	1. 0·67% of E
Q. 2τ	2. 36·8% of E
R. 3τ	3. 13·5% of E
S. 4τ	4. 5% of E
T. 5τ	5. 1·87% of E

Select the correct answer using the code given below.

(a)	P	Q	R	S	T
	1	2	3	4	5
(b)	P	Q	R	S	T
	5	2	3	4	1
(c)	P	Q	R	S	T
	1	3	2	4	5
(d)	P	Q	R	S	T
	2	3	4	5	1

114. A single-range laboratory-type potentiometer has an 18-step dial switch where each step represents 0·1 V. The dial resistors are 10 Ω each. The slide wire of the potentiometer is circular and has 11 turns and a resistance of 1 Ω per turn. The slide wire has 100 divisions and interpolation can be done to one-fourth of a division. What is the measuring range of the potentiometer?

(a) 1·1 V
(b) 0·25 V
(c) 1·91 V
(d) 0·01 V

115. Consider the following statements regarding Maxwell's bridge :

1. Maxwell's bridge is limited to measurement of low Q inductors.
2. The final balance equations of Maxwell's bridge are dependent of frequency.
3. The balance equation of Maxwell's bridge is dependent of losses associated with the inductor.

Which of the above statements is/are correct?

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

116. Match the following Lists :

List–I (Name of the bridge)	*List–II (Inductance equation)*
P. Maxwell's inductance bridge	1. $L_1 = \dfrac{R_2 R_3 C_4}{1+\omega^2 R_4^2 C_4^2}$
Q. Hay's bridge	2. $L_1 = C\dfrac{R_3}{R_4}[r(R_2+R_4)+R_2R_4]$
R. Anderson's bridge	3. $L_1 = L_2\dfrac{R_3}{R_4}$
S. Owen's bridge	4. $L_1 = R_2R_3C_4$

Select the correct answer using the code given below.

(a)	P	Q	R	S
	3	1	2	4
(b)	P	Q	R	S
	4	1	3	2
(c)	P	Q	R	S
	3	2	4	1
(d)	P	Q	R	S
	3	2	1	4

117. The coil of a moving-coil voltmeter is 40 mm long and 30 mm wide, and has 100 turns on it. The control spring exerts a torque of 240×10^{-6} N-m when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is 1 Wb/m^2, what is the resistance that must be put in series with the coil to give one volt per division? (The resistance of the voltmeter coil may be neglected)

(a) $120\times10^3\ \Omega$
(b) $50\times10^3\ \Omega$
(c) $5\times10^3\ \Omega$
(d) $12\times10^3\ \Omega$

118. Consider the following statements regarding moving-iron instruments :

1. Moving-iron instruments have their deflection proportional to the square of the current flowing through the coil.
2. Moving-iron instruments have uniform scale marking.
3. Whatever be the polarity of the current in the coil, the deflection of a moving-iron instrument is in the same direction.

Which of the above statements is/are correct?

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

119. What is the equation for deflection of the pointer in an electrodynamometer-type instrument when it is operated with AC?

(a) $\theta = \frac{I_1 I_2}{k} \cos\phi \frac{dM}{d\theta}$

(b) $\theta = \frac{I^2}{k} \frac{dM}{d\theta} \int_0^T i^2 dt$

(c) $\theta = \frac{I_1 I_2}{k} \frac{dM}{d\theta}$

(d) $\theta = \frac{1}{k} \frac{dM}{d\theta} \frac{1}{T} \int_0^T i^2 dt$

120. Consider the following statements regarding induction-type instruments :

1. If $\alpha = 0$, i.e., if two fluxes are in phase, then the net torque is maximum. If, on the other hand, $\alpha = 90°$, the net torque is maximum for given values of ϕ_{1m} and ϕ_{2m}.
2. The net torque is in such a direction as to rotate the disc from the pole with lagging flux towards the pole with leading flux.
3. The expression for torque has a steady value at all times.

Which of the above statements is/are correct?

(a) 1 and 2

(b) 2 and 3

(c) 1 only

(d) 1 and 3

121. An electrodynamometer-type wattmeter has a current coil with a resistance of 0·1 Ω and a pressure coil with resistance of 6·5 kΩ. What is the percentage error while the meter is connected as current coil to the load side, if the load is specified as 12 A at 250 V with unity power factor?

(a) 14·4%

(b) 0·48%

(c) 4·8%

(d) 1·44%

122. What is the expression for deflecting torque in single-phase induction-type energy meter?

(a) $T_d \propto \frac{\phi_p \phi_s \omega}{Z} \sin\beta \cos\alpha$

(b) $T_d \propto \frac{\phi_{1m} \phi_{2m}}{\omega Z} \sin(\alpha - \theta) \cos\beta$

(c) $T_d \propto \frac{\phi_{1m} \phi_{2m} \omega}{Z} \sin\alpha \cos\beta$

(d) $T_d \propto \frac{\phi_p \phi_s}{\omega Z} \sin\alpha \cos\beta$

123. When secondary winding of current transformer is open circuited with primary winding still energized, the large flux greatly increases the

(a) flux density in the core and pushes it towards saturation

(b) power loss in the secondary winding

(c) leakage flux manifolds

(d) power loss in the primary winding

124. The purpose of the start bit in digital voltmeter is to

(a) hold the digital word in the display for a particular time

(b) provide the display of the information that comes from the A/D conversion

(c) give zero indication on the display during start of conversion

(d) give information about polarity of the measurand voltage given by the A/D converter

125. In general, the range of digital multimeter display is

(a) –199 to +199

(b) –999 to +999

(c) –9999 to +9999

(d) –1999 to +1999

126. Which one of the following code counters is used to remove the ambiguity during the change from one state of the counter to the next during the state transition?

(a) Gray code counter

(b) BCD code counter

(c) Excess-3 code counter

(d) Binary code counter

127. Which one of the following gates is most commonly used in the design of a bus system?

(a) OR gate

(b) NOT gate

(c) XOR gate

(d) Buffer gate

128. Consider the following characteristics of CISC architecture :

1. A large number of instructions
2. A large variety of addressing modes
3. Instructions that manipulate operands in memory
4. Fixed-length instruction formats

Which of the above characteristics are correct?

(a) 1 and 2 only

(b) 2, 3 and 4

(c) 1, 2 and 4

(d) 1, 2 and 3

129. Match the following Lists related to the registers with their functions :

List–I (Register name)	*List–II (Function)*
P. Data Register (DR)	1. Holds instruction code
Q. Address Register (AR)	2. Processor register
R. Accumulator (AC)	3. Holds address of instruction
S. Instruction Register (IR)	4. Holds memory operand
T. Program Counter (PC)	5. Holds address for memory

Select the correct answer using the code given below.

(a) P Q R S T
4 5 2 1 3

(b) P Q R S T
5 4 3 1 2

(c) P Q R S T
3 5 1 2 4

(d) P Q R S T
1 4 5 2 3

130. Which one of the following types of instructions is useful for initializing registers to assign a constant value?

(a) Implied mode instructions

(b) Direct mode instructions

(c) Immediate mode instructions

(d) Indirect mode instructions

131. Which one of the following is ***not*** an operation performed by call subroutine instruction?

(a) The address of the next instruction available in the program counter is stored in a temporary location, so the subroutine knows where to return.

(b) Control is transferred to the beginning of the subroutine.

(c) The instruction return from subroutine, transfers the return address from the temporary location into the program counter.

(d) The address of the next instruction available in the program counter is stored in an accumulator and returns whenever it is required.

132. Which of the following lines/diagrams are used when the data transfer is between an interface and an I/O device?

(a) Strobe lines

(b) Handshaking lines

(c) Timing diagrams

(d) State diagrams

133. In which one of the following data transfer schemes, the CPU stays in a program loop until the I/O unit indicates that it is ready for data transfer while transferring data to and from peripherals?

(a) Programmed I/O

(b) Interrupt-initiated I/O

(c) Direct memory access

(d) Programmed interrupt I/O

134. Which one of the following methods is used to detect burst errors occurring in the communication channel?

(a) Cyclic redundancy check

(b) Bit stuffing

(c) Pulse code checking

(d) Bit spoofing

135. In operating systems, which one of the following approaches is used to keep track of system activities such as the number of system calls made or the number of operations performed to a network device or disk?

(a) Counters

(b) Tracing

(c) Scheduling

(d) Pipelining

136. The page fault occurs

(a) when a page currently in a memory is accessed

(b) when a page currently not in a memory is accessed

(c) when an existing page in a memory to replace with a new page is accessed

(d) when a page from any process in the system for replacement is accessed

137. Suppose that the failures of two drives are independent; that is, the failure of one is not connected to the failure of the other. Then, if the mean time between failures of a single drive is 100000 hours and the mean time to repair is 10 hours, the approximate mean time to data loss of a mirrored drive system is

(a) 17000 years

(b) 77000 years

(c) 47000 years

(d) 57000 years

138. Which one of the following modifiers tells the compiler that a variable's value may be changed in ways not explicitly specified by the program?

(a) Volatile

(b) Identifier

(c) Const

(d) Typedef

139. Consider the following statements regarding applications of a *p-n* junction diode :

1. It is used as a switch in DC power supplies.
2. It is used as rectifiers in voltage stabilizing circuits.
3. It is used as signal diodes in communication circuits.

Which of the above statements is/are correct?

(a) 2 only

(b) 2 and 3

(c) 3 only

(d) 1 and 3

140. Consider the following statements regarding transistors :

1. They can be made to oscillate with very small power consumption.
2. They cannot sustain mechanical shocks.
3. Their application is limited up to a few mega-cycles only.

Which of the above statements is/are correct?

(a) 2 only

(b) 2 and 3

(c) 3 only

(d) 1 and 3

141. A field-effect transistor operates with a drain current of 100 mA and a gate source bias of −1 V. The device has dynamic forward transconductance value of 0·25 S. If the bias voltage decreases to −1·2 V, what is the new value of the drain current?

(a) 50 mA

(b) 75 mA

(c) 150 mA

(d) 125 mA

142. Match the following Lists regarding bipolar junction transistors :

List–I (Type of transistor)	*List–II (Application)*
P. BC108 (*n-p-n*)	1. Switching
Q. BF180 (*n-p-n*)	2. General-purpose small-signal amplifier
R. 2N3904 (*n-p-n*)	3. Low-frequency power
S. 2N3055 (*n-p-n*)	4. RF amplifier

Select the correct answer using the code given below.

(a)	P	Q	R	S
	4	2	1	3
(b)	P	Q	R	S
	4	3	2	1
(c)	P	Q	R	S
	3	4	1	2
(d)	P	Q	R	S
	2	4	1	3

143. Consider the following statements regarding *p-n-p* transistor :

1. The base-collector junction is reverse biased to holes in the base region and electrons in the collector region.
2. The base region is very thin and is only lightly doped with electrons.
3. A large proportion of the electrons in the base region cross the base-collector junction into the collector region, creating a collector current.

Which of the above statements is/are correct?

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

144. For a JFET, the typical values of amplification factor and transconductance are specified as 80 and 200 μS respectively. What is the dynamic drain resistance of this JFET?

(a) 25 kΩ

(b) 25 μΩ

(c) 400 kΩ

(d) 400 μΩ

145. There is no need of a driver stage, if FET is used as power amplifier instead of BJT, because

(a) FET digital circuits need much less power compared to BJT circuits

(b) there is no risk of thermal runaway in FET circuits

(c) power gain of an FET is much higher than that of a BJT

(d) FET is essentially a voltage-operated device

146. Match the following Lists regarding field-effect transistor amplifiers :

List–I (Configuration)	*List–II (Typical application)*
P. Common source	1. Impedance matching stages
Q. Common drain	2. General-purpose, AF and RF amplifiers
R. Common gate	3. RF and VHF amplifiers

Select the correct answer using the code given below.

(a)	P	Q	R
	2	1	3
(b)	P	Q	R
	1	3	2
(c)	P	Q	R
	3	2	1
(d)	P	Q	R
	2	3	1

147. Match the following Lists regarding bipolar transistor amplifiers :

List–I (Configuration)	*List–II (Typical application)*
P. Common emitter	1. RF and VHF amplifiers
Q. Common collector	2. Impedance matching, input and output stages
R. Common base	3. General-purpose, AF and RF amplifiers

Select the correct answer using the code given below.

(a)	P	Q	R
	2	1	3
(b)	P	Q	R
	1	3	2
(c)	P	Q	R
	3	2	1
(d)	P	Q	R
	3	1	2

148. Consider the following statements regarding frequency response of BJT amplifiers :

1. The CE amplifier has a high gain but a relatively narrow bandwidth.
2. The CC amplifier has a lower gain but a larger bandwidth.
3. The CB amplifier has a higher gain and a larger bandwidth.

Which of the above statements is/are correct?

(a) 2 only

(b) 2 and 3

(c) 3 only

(d) 1 and 2

149. In a common-collector amplifier stage, the impedance between base and emitter is magnified because of

(a) source resistance

(b) negative feedback

(c) Miller effect

(d) high-frequency response

150. In Colpitts oscillator circuits, the amount of feedback is controlled by the

(a) position of the coil tap

(b) ratio of inductances

(c) ratio of capacitances

(d) ratio of resistances

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