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**T. B. C. : AE(E) – 1/2015**

**Test Booklet Series**

**Serial No.** 6197

**A**

# TEST BOOKLET

## ASSISTANT EXECUTIVE ENGINEER

## ELECTRICAL ENGINEERING (PAPER – I)

*Time Allowed : 3 Hours*

*Maximum Marks : 180*

**: INSTRUCTIONS TO CANDIDATES :**

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 OF THE SAME SERIES ISSUED TO YOU.
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 USING BALL POINT PEN (BLUE OR BLACK).
3. You have to enter your **Roll No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains **90** items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).
5. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided, by **using BALL POINT PEN (BLUE OR BLACK)**. See instructions in the Answer Sheet.
6. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There will be no negative marking for wrong answer.**
7. Before you proceed to mark (darken) in the Answer Sheet the responses to various items (questions) in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions in your **Admission Certificate.**
8. After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy/second page of the Answer Sheet along with the *Test Booklet* after completion of the examination for your reference.

SEAL

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

1. Which of the following statements is correct ?

   (A) The current in a short circuit is always zero

   (B) The current in an open circuit is always zero

   (C) The resistance in an open circuit is always zero

   (D) None of the above

2. Which of the following statements is correct ?

   (A) The voltage in a short circuit is always zero

   (B) The voltage in a open circuit is always zero

   (C) The resistance in a short circuit is always infinity

   (D) None of the above

3. Several light bulbs are connected in parallel and one light bulb burns out, the other light bulbs :

   (A) All bulbs stop working

   (B) All bulbs light more

   (C) All bulbs burn out

   (D) None of the above

4. Several light bulbs are connected in series and one light bulb burns out, the other light bulbs :

   (A) All bulbs stop working

   (B) All bulbs light more

   (C) All bulbs burn out

   (D) None of the above

5. Fuses are used to :

   (A) Protect the circuit / equipment

   (B) Keep wires from getting overheated

   (C) Break the circuit when too much current is being used

   (D) All of the above

6. An electric kettle is rated at 1000 W for use in a 220-V circuit. A 12A circuit fuse / breaker is installed on the circuit. How many kettles can be safely operated in the circuit ?

   (A) More than 4

   (B) 3

   (C) 2

   (D) 1

7. Electrical devices in our homes are connected in :

(A) Parallel

(B) Series

(C) Both series and parallel

(D) None of the above

8. If you plug an electric toaster rated at 110V into a 220-V outlet, current in the toaster will be :

(A) The same as if it were plugged into 110V

(B) Twice what it should be

(C) Half what it should be

(D) None of the above

9. When a current 'I' flows through a resistance 'R' for time 't', the electrical energy spent is given by :

(A) $IR \cdot t$

(B) $I^2R \cdot t$

(C) $IR^2 \cdot t$

(D) $I^2R/t$

10. Kilowatt-hour is the unit of :

(A) Potential difference

(B) Electric power

(C) Electrical energy

(D) Electric charge

11. The power dissipated in a resistor is directly proportional to :

(A) The current through this resistor

(B) The resistor value

(C) The voltage across the resistance

(D) All of the above

12. Transformer action requires :

(A) Alternating electric flux

(B) Alternating magnetic flux

(C) Constant magnetic flux

(D) Any of the above

13. A commutator in a dc generator provides :

(A) Half-wave rectification

(B) Full-wave rectification

(C) Half-wave controlled rectification

(D) Full-wave controlled rectification

14. In a three-phase induction motor, the maximum torque is :

(A) Independent of rotor resistance

(B) Proportional to rotor resistance

(C) Proportional to square of rotor resistance

(D) Proportional to square root of rotor resistance

15. Rated speed of a three-phase induction motor is 1,440 rpm for 50 Hz supply, the number of pole is :

(A) 6-pole

(B) 2-pole

(C) 8-pole

(D) 4-pole

16. If the roter of induction motor rotates at synchronous speed, the torque produced is :

(A) High

(B) Low

(C) Zero

(D) Infinity

17. In 50 Hz induction machine, if the no load speed is 745 rpm, the synchronous speed is :

(A) 700 rpm

(B) 750 rpm

(C) 800 rpm

(D) 850 rpm

18. In 50Hz induction machine, if the no load speed is 2900 rpm, the slip frequency is :

(A) 0.33 Hz

(B) 0.67 Hz

(C) 1.33 Hz

(D) 1.67 Hz

19. If P = number of poles and N = revolution made per second, what is the frequency of an alternator ?

(A) PN / 2 Hz

(B) 120 / PN Hz

(C) 120 N / P Hz

(D) 120 P / N Hz

20. A series motor is efficiently suitable for :

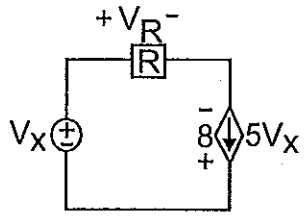
(A) High starting torque operation

(B) Low starting torque operation

(C) Constant speed operation

(D) None of the above

21. Refer to the circuit of figure below, if $V_X$ = 1 V, $V_R$ = 9 V, then the power absorbed by element R is :




(A) 5 W

(B) 9 W

(C) 40 W

(D) 45 W

22. A certain practical dc voltage source can provide a current of 2.5 A when it is short-circuited and can provide a power of 80 W to a 20-Ω load. The open circuit voltage of the source is :

(A) 22.2 V

(B) 80 V

(C) 8.88 V

(D) 200 V

23. The current through a capacitor is given by $i(t) = 7 \sin(\pi t)$ mA. If the energy stored at t = 200 ms is 3 μJ, what is the value of the capacitance ?

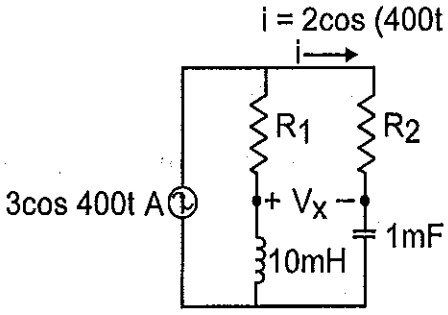
(A) 2.99 mF

(B) 3.02 μF

(C) 18.14 nF

(D) 7.00 mF

24. The value of voltage $V_X$ in the following circuit is :




(A) $9.89 \cos(400t + 78.76^\circ)$ V

(B) $7.80 \cos(400t + 48.9^\circ)$ V

(C) $5.00 \cos(400t - 50^\circ)$ V

(D) $1.95 \cos(400t - 41.21^\circ)$ V

25. The power delivered in VA to a load that draws 500 W at a leading power factor of 0.75 is :

(A) $500 \angle -41.41^\circ$

(B) $500 \angle +41.41^\circ$

(C) $666.7 \angle -41.41^\circ$

(D) $666.7 \angle +41.41^\circ$

26. For a particular circuit, it is known that $V_{12} = 100 \angle 0^\circ$, $V_{45} = 60 \angle 75^\circ$, $V_{42} = 80 \angle 120^\circ$ and $V_{35} = -j120$, all in volts. Then $V_{25}$ in volts will equal to :

(A) $189.8 \angle 34.95^\circ$

(B) $56.67 \angle -11.52^\circ$ V

(C) $80 \angle 130^\circ$

(D) $43.48 \angle -40^\circ$

27. A parallel RLC circuit is measured to have a quality factor ($Q_o$) of 200 at resonant frequency. The value of L, if R = 1 kΩ and C = 1 μF is :

(A) 25 pH

(B) 25 μH

(C) 40 mH

(D) 40 nH

28. A signal $x(t) = 10e^{-2t}u(t)$ is applied to a linear system for which the impulse response is $h(t) = 10e^{-2t}u(t)$. The output y(t) is :

(A) $y(t) = 100e^{-2t}u(t)$

(B) $y(t) = 100te^{-2t}u(t)$

(C) $y(t) = 10e^{-2t}u(t)$

(D) $y(t) = 10te^{-2t}u(t)$

29. If $f(t) = 5e^{-2t}u(t)$ and $g(t) = 4e^{-3t}u(t)$, then $f(t) * g(t)$ will be equal to :

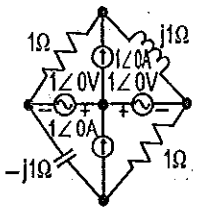
(A) $(e^{-2t} - e^{-3t})$

(B) $20(e^{-2t} - e^{-3t})$

(C) $20(e^{-3t} - e^{-2t})$

(D) $(e^{-3t} - e^{-2t})$

30. In the circuit shown below, the current through the inductor is :




(A) $\frac{2}{1+j}$ A

(B) $\frac{-1}{1+j}$ A

(C) $\frac{1}{1+j}$ A

(D) 0 A

31. For the circuit shown in the figure, the voltage and current expressions are $v(t) = E_1 \sin(\omega t) + E_3 \sin(3\omega t)$ and $i(t) = I_1 \sin(\omega t - \varphi_1) + I_3 \sin(3\omega t - \varphi_3) + I_5 \sin(5\omega t)$. The average power measured by the wattmeter is :

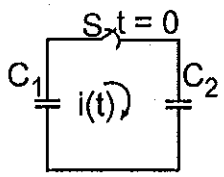
(A) $\frac{1}{2} E_1 I_1 \cos \varphi_1$

(B) $\frac{1}{2} [E_1 I_1 \cos \varphi_1 + E_1 I_3 \cos \varphi_3 + E_1 I_5]$

(C) $\frac{1}{2} [E_1 I_1 \cos \varphi_1 + E_3 I_3 \cos \varphi_3]$

(D) $\frac{1}{2} [E_1 I_1 \cos \varphi_1 + E_3 I_1 \cos \varphi_1]$

32. In the following figure, $C_1$ and $C_2$ are ideal capacitors. $C_1$ has been charged to 12 V before the ideal switch S is closed at t = 0. The current i(t) for all t is :



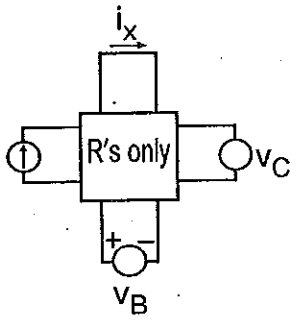

(A) Zero

(B) A step function

(C) An exponentially decaying function

(D) An impulse function

33. With sources $i_A$ and $v_B$ in the following circuit and $v_C = 0$, $i_X = 20$ A, with $i_A$ and $v_C$ on and $v_B = 0$, $i_X = -5$ A and finally, with all three sources on, $i_X = 12$ A, the value of $i_X$ if only $i_A$ is operating is :




(A) –8

(B) 3 A

(C) 17 A

(D) 20

34. A circuit consists of a 0.5 H inductor, a 10 Ω resistor and a 40 Ω resistor in series. The inductor current is 4 A at t = 0. The inductor current after 15 ms becomes :

(A) 0.89 A

(B) 0.68 A

(C) 0.57 A

(D) 0.45 A

35. A practical current source provides 10 W to a 250 Ω load and 20 W to an 80 Ω load. A resistance $R_L$ with voltage $v_L$ and current $i_L$, is connected to it. If $i_L$ is a maximum, then the value of $R_L$ is :

(A) 33.33 Ω

(B) Infinite

(C) Zero

(D) 60.61 Ω

36. The voltage across a 5 H inductor is $v_L(t) = 10\ (e^{-t} - e^{-2t})$ v. If $i_L(0) =$ 80 mA, the final value of inductor current is :

(A) 0.08 A

(B) 1.08 A

(C) 0.47 A

(D) Zero

37. A current source of 4 A, a 20 Ω resistor and a 5 μF capacitor are all in parallel. The amplitude of the current source drops suddenly to zero at t = 0. The time at which the capacitor voltage drops to one-half of its initial value is :

(A) 34.66 μs

(B) 69.31 μs

(C) 0.69 μs

(D) 507.5 μs

38. If the admittance of the parallel combination of a 10 Ω resistance and a 50 μF capacitance at ω = 1 krad/s is the same as the admittance of $R_1$ and $C_1$ in the series at that frequency, then the value of $C_1$ is :

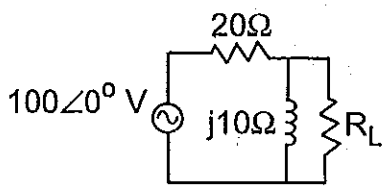
(A) 250 μF

(B) 0.05 μF

(C) 100 μF

(D) 8 μF

39. The value of $R_L$ in the following circuit that will absorb a maximum power is :




(A) 4 Ω

(B) 8 Ω

(C) 12 Ω

(D) 8.9 Ω

40. If $f(0^-) = -3$ and $15u(t) - 4\delta(t) = 8f(t) + 6f'(t)$, then f(t) will be equal to :

(A) $(18.75 - 55.42e^{-\frac{4t}{3}})u(t)$

(B) $(1.875 - 5.542e^{-\frac{4t}{3}})u(t)$

(C) $(5.542 - 1.875e^{-\frac{3t}{4}})u(t)$

(D) $(55.42 - 18.75e^{-\frac{3t}{4}})u(t)$

41. A system has an overall transfer function T(s) equal to $\frac{a^2}{s^2(s+a)}$, where a is a positive constant. For large values of time t, the output approximately resembles :

(A) Ramp function

(B) A unit step function

(C) An exponential function

(D) A quadratic function

42. The output of a linear time invariant control system is c(t) for a certain input r(t). If r(t) is modified by passing it through a block whose transfer function is $e^{-s}$ and then applied to the system, the modified output of the system would be :

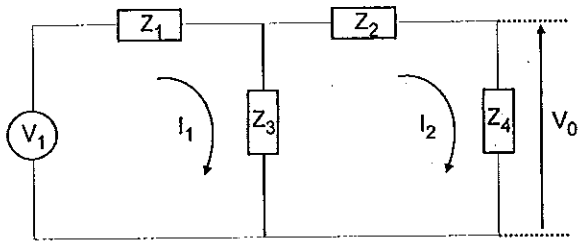
(A) $c(t-1)u(t-1)$

(B) $c(t)u(t-1)$

(C) $c(t)/u(t+1)$

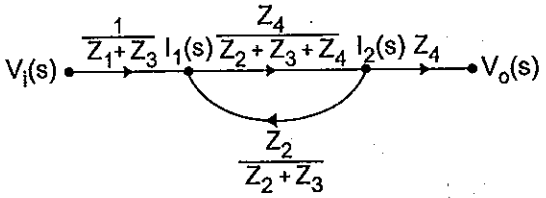
(D) $c(t)/(1+e^{-t})$

43.

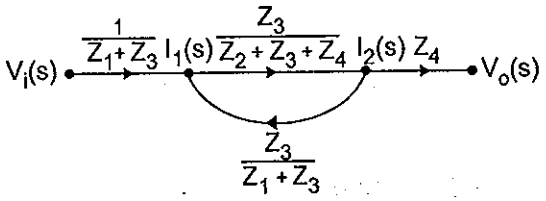



The signal flow graph for the above system is :

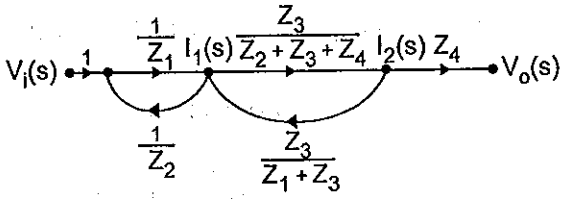
(A)



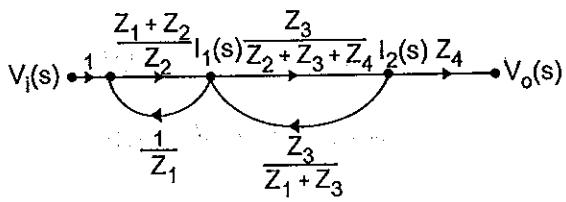

(B)




(C)




(D)




44. If for a closed loop control system having open loop gain G(s) and feedback path gain H(s), the position error constant $K_p = 1$ and acceleration error constant $K_a = 0.5$ then the steady state error for input $r(t) = (2 + t^2)u(t)$ is :

(A) –1

(B) 5

(C) 8

(D) –4

45. A system has overall closed loop gain $\frac{36}{s^2 + 9s + 36}$. If a step input is given to the system, what is the time duration between first two successive peak overshoots ?

(A) 1.58

(B) $2\pi / 3$

(C) 0.81

(D) 1.8

46. A system has overall transfer function $T(s) = \frac{G(s)}{1 + G(s)H(s)}$. The expression for peak time $t_p$ can be obtained by equating to zero, the derivative of :

(A) Input r(t) with respect to time

(B) The convolution of r(t) and $L^{-1}[T(s)]$ with respect to time

(C) C(s) / R(s) with respect to time where C(s) is the system response

(D) $\delta(t)T(p)$ with respect to time, where $\delta(t)$ is the impulse response

47. If state equation is $\dot{X}(t) = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} X$ and $X(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$. The states X(t) for any time $t > 0$ are :

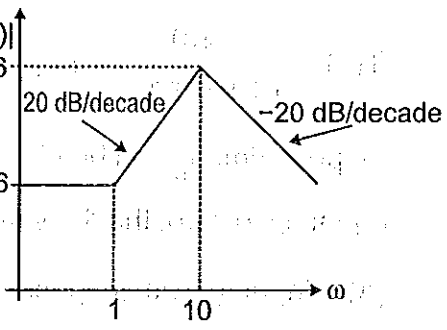
(A) $\begin{bmatrix} e^t \\ 3te^t \end{bmatrix}$

(B) $\begin{bmatrix} 2e^{-t} \\ 3te^{-t} + 2e^{-t} \end{bmatrix}$

(C) $\begin{bmatrix} e^t \\ 3te^t + 2e^t \end{bmatrix}$

(D) $\begin{bmatrix} e^{-t} \\ 3te^{-t} + 2e^{-t} \end{bmatrix}$

48. $|G(j\omega)|$




The transfer function of the above bode plot may be :

(A) $\dfrac{2(1+s)^2}{\left(1+\dfrac{s}{10}\right)^2}$

(B) $\dfrac{2(1+s)}{\left(1+\dfrac{s}{10}\right)^2}$

(C) $\dfrac{2(1+s)}{\left(1+\dfrac{s}{10}\right)}$

(D) $\dfrac{2(1+s)}{(1+10s)^2}$

49. The Asymptote in the Bode Plot for $G(j\omega) = \dfrac{1}{(1+j\omega)^2}$ :

(A) $|G(j\omega)| = -20$ dB line and a line of slope – 40 dB/decade

(B) $|G(j\omega)| = -40$ dB line and $|G(j\omega)| = -20$ dB line

(C) $|G(j\omega)| = -40$ dB line and a line of slope – 40 dB/decade

(D) $|G(j\omega)| = -0$ dB line and a line of slope – 40 dB/decade

50. When a lag compensator is used for the compensation of a system, the magnitude bode plot of the compensated system :

(A) Remains unaltered

(B) Always lies below the uncompensated system

(C) Always lies above the uncompensated system

(D) Remains unaltered upto some low frequency and lies below the uncompensated system for higher frequencies.

51. _____ causes offset error and _____ can be used to remove it.

(A) Integral controller, proportional controller

(B) Proportional controller, integral controller

(C) Integral controller, derivative controller

(D) Derivative controller, integral controller

52. The ac motor used in servo application is a :

(A) Single phase induction motor

(B) Two phase induction motor

(C) Three phase induction motor

(D) Synchronous motor

53. A block with transfer function $G(s) = \frac{s+2}{s+1}$ is connected in cascade to a zero order hold. The sampled data transfer function G(z) of this discrete time system is :

(A) $\frac{z-1}{z}\left(\frac{2z}{z-1} - \frac{z}{z-e^{-T}}\right)$

(B) $\frac{z}{z-1}\left(\frac{2}{z} - \frac{1}{z+1}\right)$

(C) $\frac{z-1}{z}\left(\frac{2z}{z-1} + \frac{z}{z-e^{-T}}\right)$

(D) $\frac{z-1}{z}\left(\frac{2}{z} - \frac{1}{z+1}\right)$

54. A function f(t) is defined as :

$$f(t) = \begin{cases} \infty; \text{ at } t=0 \\ 0; t \neq 0 \end{cases}$$

And the total area $\int_{-\infty}^{\infty} f(t) = 1$

It was found that when this signal is applied to the system, the system output $\rightarrow 0$ as $t \rightarrow \infty$.

(A) The system is asymptotically stable

(B) The system is unstable

(C) The system is marginally stable

(D) The stability of the system cannot be judged from the information given

55. The first two rows of Routh's tabulation of a third order equation are as follows :

| | | |
|---|---|---|
| $s^3$ | 2 | 2 |
| $s^2$ | 4 | 4 |

This means there are :

(A) Two roots at $s = \pm j$ and one root in right half s-plane

(B) Two roots at $s = \pm j$ and one root in left half s-plane

(C) Two roots at $s = \pm j2$ and one root in right half s-plane

(D) Two roots at $s = \pm j2$ and one root in left half s-plane

56. The transfer function of a system is given as $\frac{100}{s^2 + 20s + 100}$ :

(A) An over damped system

(B) An under damped system

(C) An critically damped system

(D) An unstable system

57. A system with zero initial conditions has the closed loop transfer function.

$$\frac{s^2 + 4}{(s+1)(s+4)}$$

The system output is zero at the frequency :

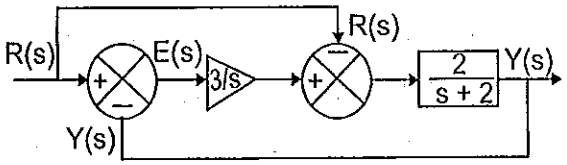
(A) 0.5 rad/sec

(B) 1 rad/sec

(C) 2 rad/sec

(D) 4 rad/sec

58. When subject to a unit step input, the closed loop control system shown in the figure given below will have a steady state error of :




(A) – 1.0

(B) – 0.5

(C) 0

(D) 0.5

59. For the equation $s^3 - 4s^2 + s + 6 = 0$, the number of roots in the left half of s-plane will be :

(A) Zero

(B) One

(C) Two

(D) Three

60. The Nyquist plot of loop transfer function G(s)H(s) of a closed loop control system passes through the point (– 1, j0) in the GsHs ( ) ( ) plane. The phase margin of the system is :

(A) $0^o$

(B) $45^o$

(C) $90^o$

(D) $180^o$

61. The limiting error of measurement of power consumed by the current passing through a resistance are ± 1.5% and ± 1% respectively. Then the limiting error of measurement of resistance will be :

(A) ±0.5%

(B) ±0.1%

(C) ±0.25%

(D) ±3.5%

62. A CRO screen has ten divisions on the horizontal scale. If a voltage signal $5 \sin(314t + 45^{o})$ is examined with a line base setting of 5 m sec/div, the number of cycles of signal displayed on the screen will be :

(A) 0.5 cycle

(B) 2.5 cycles

(C) 5 cycles

(D) 10 cycles

63. The number of comparators needed in a parallel conversion type 8-bit analog to digital convertor is :

(A) 8

(B) 16

(C) 255

(D) 256

64. An LVDT is used to measure displacement. The output of the LVDT is connected to a voltmeter of range 0 to 5 V through an amplifier having a gain of 250. For a displacement of 0.5 mm, the output of the LVDT is 0.5 mV. The sensitivity of the instrument would be :

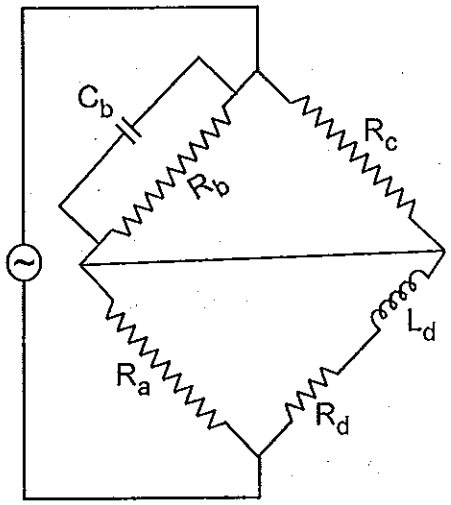
(A) 0.1 V/mm

(B) 0.5 V/mm

(C) 1 V/mm

(D) 5V/mm

65. For the ac bridge shown in the figure at balance, the value of $R_d$, $L_d$ and $Q_d$ will be respectively :




(A) $(R_aR_b)/R_c$ ; $R_aR_c/C_b$ ; $wC_bR_b$

(B) $(R_aR_b)/R_c$ ; $R_aR_c/C_b$ ; $wC_bR_b$

(C) $(R_aR_b)/R_c$ ; $R_aR_c/C_b$ ; $wC_bR_b$

(D) $(R_aR_b)/R_c$ ; $R_aR_c/C_b$ ; $wC_bR_b$

66. The velocity of flow v, using Snell's law of refraction applicable to sound waves is :

(A) $\frac{cf_1}{2\Delta f \sin\theta}$

(B) $\frac{c\Delta f}{2f_1 \sin\theta}$

(C) $\frac{2f_1 \sin\theta}{c\Delta f}$

(D) $\frac{2cf_1}{\Delta f \sin\theta}$

67. For gas pressure below 1 mmHg, the thermal conductivity of gas is :

(A) Independent of pressure

(B) Dependent of pressure

(C) Independent of volume

(D) Dependent of volume

68. In a digital voltmeter, the oscillator frequency is 400 KHz and ramp voltage falls from 8 V to 0 V is 20 msec. The number of pulses counted by the counter is :

(A) 800

(B) 2000

(C) 4000

(D) 8000

69. The fact as to how closely the instrument reading follows the measured variables is called the :

(A) Precision

(B) Fidelity

(C) Accuracy

(D) Sensitivity

70. The ratio and phase angle errors in potential transformer may be reduced by :

(A) Increasing the exciting current

(B) Increasing the resistance and leakage reactance in the transformer

(C) By not employing turns compensation

(D) None of the above

71. A dual trace CRO has a number of time base circuit of :

(A) 1

(B) 2

(C) 3

(D) 4

72. The deflection of a moving coil galvanometer becomes one-fourth when shunted by 20 ohms resistance. The resistance of the galvanometer is :

(A) 10

(B) 40

(C) 60

(D) 50

73. A galvanometer with a resistance of G ohms is shunted by a resistance of S ohms. The resistance to be added for the current to remain unchanged is :

(A) S/S + G

(B) G/G +S

(C) SG/G + S

(D) $G^2/G + S$

74. The term artificial ageing in instruments is associated with :

(A) Springs

(B) Permanent Magnet

(C) Damper

(D) Both (A) and (B)

75. Which one of the following DVM has excellent noise rejection feature ?

(A) Ramp type DVM

(B) Dual slope type DVM

(C) Successive approximation type DVM

(D) Flash type DVM

76. By saying that the electrostatic field is conservative, we do not mean that :

(A) It is the gradient of a scalar potential

(B) Curl is identically zero

(C) The work done in a closed path inside the field is zero

(D) The potential difference between the two points is zero

77. If $\bar{\nabla}\bar{b} = \varepsilon\bar{\nabla}\cdot\bar{E}$ and $\bar{\nabla}\cdot\bar{J}\ \sigma\bar{\nabla}\cdot\bar{E}$ in a given material, the material is said to be :

(A) Linear

(B) Isotropic

(C) Linear and homogeneous

(D) Linear and Isotropic

78. Which of the following potential does not satisfy Laplace's equation ?

(A) V = 2x + 5

(B) V = r cos $\phi$

(C) V = $\rho$ cos $\phi$ + 10

(D) V = 10xy

79. In a certain medium, electric field E = 10 cos $(10^8t - 3y)\ \hat{a}_x$ v/m. What type of medium is it ?

(A) Free space

(B) Perfect dielectric

(C) Lossless dielectric

(D) Perfect conductor

80. In the free space, magnetic field intensity at any point $(\rho, \phi, z)$ is given by $\bar{H} = 2\rho^2 \hat{a}_\phi$ A/m, the current density at $\rho = 2m$ will be :

(A) $12 \hat{a}_z A/m^2$

(B) $24 \hat{a}_z A/m^2$

(C) $4 \hat{a}_z A/m^2$

(D) 0

81. For the lossless transmission line which of the following option is correct for attenuation constant $\alpha$ and phase constant $\beta$ ?

(A) $\alpha = 0 \quad \beta = \omega\sqrt{LC}$

(B) $\beta = 0 \quad \alpha = \omega\sqrt{LC}$

(C) $\alpha = \beta = \omega\sqrt{\frac{\mu\varepsilon}{2}}$

(D) None of the above

82. Identify which of the following expressions are not Maxwell's equations for time varying fields :

(A) $\bar{\nabla} \cdot \bar{D} = \rho_v$

(B) $\bar{\nabla} \cdot \bar{E} = \frac{-\partial \bar{B}}{\partial t}$

(C) $\oint \bar{H} \cdot \bar{dl} = \int \left( \sigma \bar{E} + \varepsilon \frac{\partial \bar{E}}{\partial t} \right) \cdot \bar{ds}$

(D) $\oint \bar{B} \cdot \bar{ds}$

83. A loop is rotating about the y-axis in a magnetic field $\bar{B} = Bo \sin \omega t \, \hat{a}_x$ wb/m$^2$. The voltage reduced in the loop is due to :

(A) Motional emf

(B) Transformer emf

(C) A combination of motional and transformer emf

(D) None of the above

84. In cylindrical coordinates the equation $\frac{\partial^2 \Psi}{\partial \rho^2} + \frac{1}{\rho}\frac{\partial^2 \psi}{\partial \phi^2} + \frac{\partial^2 \Psi}{\partial z^2} + 10 = 0$ is called :

(A) Laplace's equation

(B) Helmholtz's equation

(C) Maxwell's equation

(D) Poisson's equation

85. If $J = \frac{1}{r^3}(2\cos\theta \hat{a}_r + \sin\theta \hat{a}_\theta) \frac{A}{m^2}$, the current passing through a hemispherical shell of radius 20 cm, $0<\theta<\pi/2$, $0<\theta<2/\pi$ :

(A) $\pi$

(B) $10\pi$

(C) $0.1\pi$

(D) None of the above

86. Volume charge density in the free space is given by :

$\rho_v = 1/r^2$ c/m$^3$ $0 < r < 3$ m

$= 0 \quad r > 3$ m

Net charge within the surface r = 1 m is :

(A) $4\pi C$

(B) $-\pi C$

(C) $2\pi C$

(D) 0C

87. Dielectric strength of a material depends on :

(A) Moisture content

(B) Temperature

(C) Thickness

(D) All of the above

88. Which of the following is a vector quantity ?

(A) Relative permeability

(B) Magnetic field intensity

(C) Flux density

(D) Magnetic potential

89. "The total electric flux through any closed surface surrounding charges is equal to the amount of charge enclosed." The above statement is associated with :

(A) Coulomb's Square Law

(B) Gauss' Law

(C) Maxwell's First Law

(D) Maxwell's Second Law

90. A field line and an equipotential surface are :

(A) Always parallel

(B) Always at $90^\circ$

(C) Inclined at any angle 0

(D) None of the above

## SPACE FOR ROUGH WORK

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