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

T.B.C. : O-FTF-J-FFA

Test Booklet Series

Serial N⁰ 028441

A

TEST BOOKLET

ELECTRICAL ENGINEERING
Paper I

Time Allowed : Two Hours

Maximum Marks : 200

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). 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 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. What does the expression $\frac{1}{2}\vec{J}.\vec{A}$ represent ?

   (a) Power density

   (b) Radiation resistance

   (c) Magnetic energy density

   (d) Electric energy density

2. Consider the following statements :

   In an n-type semiconductor

   1. Fermi level lies below the donor level at room temperature (T).

   2. Fermi level lies above the donor level as $T \rightarrow 0$.

   3. Fermi level lies in valence band.

   4. Fermi level remains invariant with temperature.

   Which of the above statements is/are correct ?

   (a) 1 only

   (b) 1 and 2 only

   (c) 2, 3 and 4

   (d) 1, 2 and 3

3.
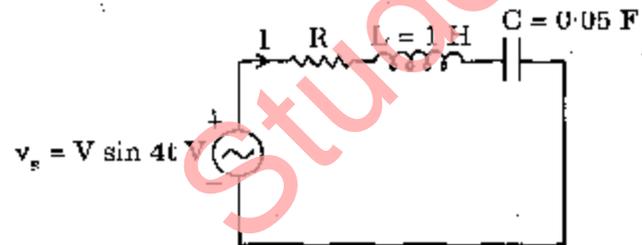
   For the circuit as shown above, if the current leads the applied voltage by $\tan^{-1} 2$, what is the resistance value in ohm ?

   (a) 0·5

   (b) 1·0

   (c) 2·0

   (d) 9·5

4. The dead zone in a pyrometer is 0·125 percent of the span. The instrument is calibrated from 500° C to 2000° C. What temperature change must occur before it can be detected in degree Centigrade ?

   (a) 187·5

   (b) 1·875

   (c) 18·75

   (d) 0·1875

5.
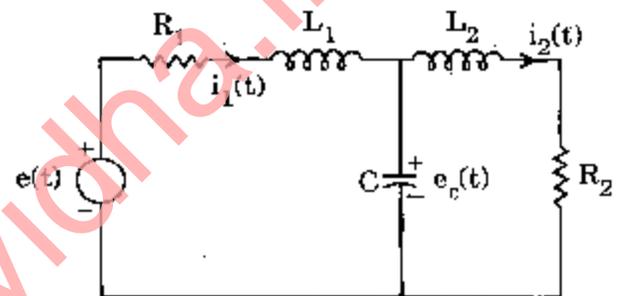
   Consider the following equations with respect to the above network :

   1. $L_1 \dfrac{di_1(t)}{dt} = R_1 i_1(t) - e_c(t) + e(t)$

   2. $L_1 \dfrac{di_1(t)}{dt} = -R_1 i_1(t) - e_c(t) + e(t)$

   3. $L_2 \dfrac{di_2(t)}{dt} = -R_2 i_2(t) + e_c(t)$

   4. $C \dfrac{de_c(t)}{dt} = i_1(t) - i_2(t)$

   Which of the above statements is/are correct ?

   (a) 1 only

   (b) 2, 3 and 4

   (c) 1, 3 and 4

   (d) 1, 2 and 4

6.
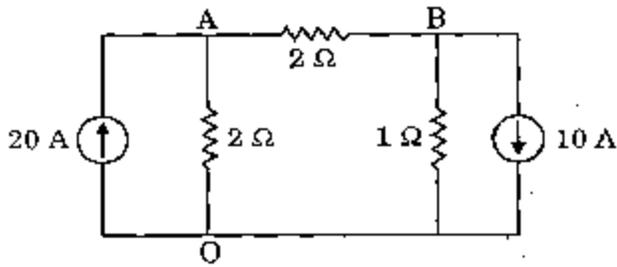
Find the voltage of the node A with respect to 'O' for the circuit as shown.

(a) 40 V

(b) 20 V

(c) 50 V

(d) 60 V

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

List I (Type of Instrument)		List II (Example)	
A.	Indicating	1.	Wattmeter
B.	Absolute	2.	Tangent galvanometer
C.	Recording	3.	Aneroid barometer
D.	Integrating	4.	Energy meter

Code :

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

8.

Zero friction
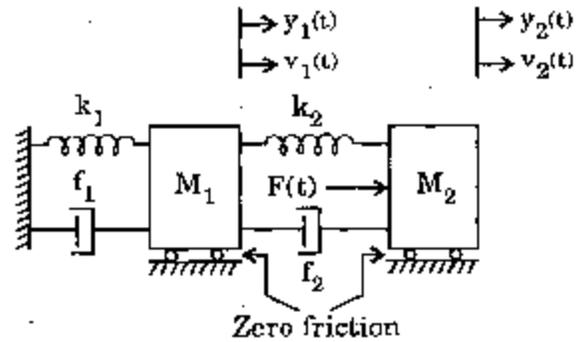
$y_1(t)$ & $y_2(t)$ are displacements

$v_1(t)$ & $v_2(t)$ are velocities.

Which one of the following is the correct free body diagram for the physical system as shown in the figure above ?
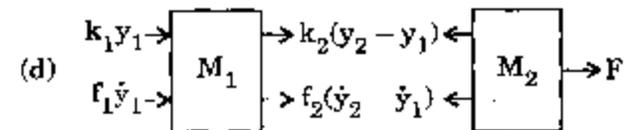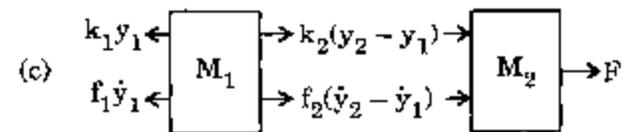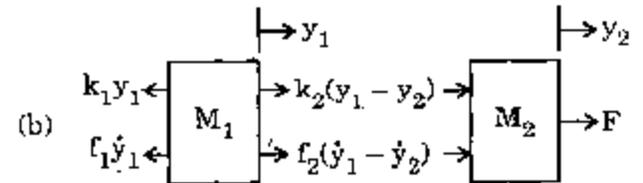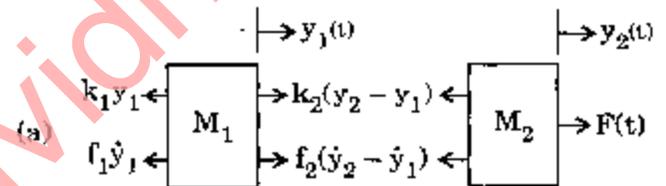
9. In a fluid flow system two fluids are mixed in appropriate proportion. The concentration at the mixing point is y(t) and it is reproduced without change, T_d seconds later at the monitoring point as b(t). What is the transfer function between b(t) and y(t) ? (Where S is distance between monitoring point and mixing point)

   (a) e^{-T_d}

   (b) $e^{+T_d S}$

   (c) $e^{-T_d S}$

   (d) e^{+T_d}

10. The strain gauge with a resistance of 250 ohm undergoes a change of 0·15 ohm. During a test the strain is $1·5 \times 10^{-4}$. What is the gauge factor ?

    (a) 4·7

    (b) 4·0

    (c) 3·5

   (d) 2·0

11.

$v = 150\sqrt{2}\sin 500\,t\ V$
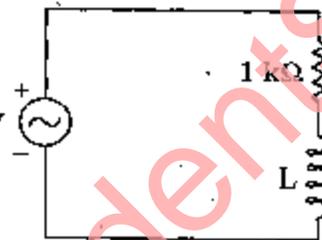
For the AC circuit as shown above, if the rms voltage across the resistor is 120 V, what is the value of the inductor ?

    (a) 0·5 H
    (b) 0·6 H
    (c) 1·0 H
    (d) 1·5 H

12. Which one of the following bridges will be used for the measurement of very low resistance ?
    (a) Kelvin bridge
    (b) Maxwell's bridge
    (c) Wheatstone bridge
    (d) Hay's bridge

13.
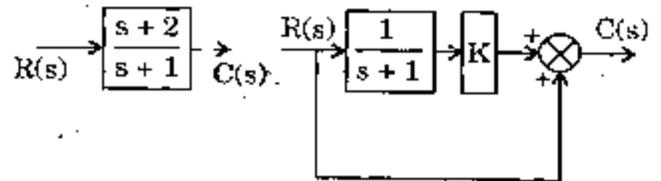
For what value of K, are the two block diagrams as shown above equivalent ?

    (a) 1

    (b) 2

    (c) (s + 1)

    (d) (s + 2)

14. Consider the following :

    1. Rise time

    2. Settling time

    3. Delay time

    4. Peak time

    What is the correct sequence of the time domain specifications of a second order system in the ascending order of the values ?

    (a) $2 - 4 - 1 - 3$

    (b) $3 - 4 - 1 - 2$

    (c) $2 - 1 - 4 - 3$

    (d) $3 - 1 - 4 - 2$

15. The oscilloscope has an input capacitance of 50 pF and a resistance of 2 MΩ and the voltage divider ratio (k) of 10. What are the parameters of a high-impedance probe ?

    (a) $C_1 = 5·55$ pF and $R_1 = 9$ MΩ

    (b) $C_1 = 5·55$ pF and $R_1 = 18$ MΩ

    (c) $C_1 = 8·33$ pF and $R_1 = 9$ MΩ

    (d) $C_1 = 1·11$ pF and $R_1 = 18$ MΩ

16. A unity feedback system with open loop transfer function of $\frac{20}{s(s+5)}$ is excited by a unit step input. How much time will be required for the response to settle within 2% of final desired value ?

(a) 0·25 sec

(b) 1·60 sec

(c) 2·40 sec

(d) 4·00 sec

17. Consider the following statements :

1.   Amplifier gain and phase shift.

2.   Filter transfer functions.

3.   Two port network parameters.

4.   Power gain in a two port circuit.

Which of the above quantities can be measured using a vector voltmeter ?

(a) 1 and 3 only

(b) 1, 2 and 4

(c) 1, 2 and 3

(d) 3 and 4

18.
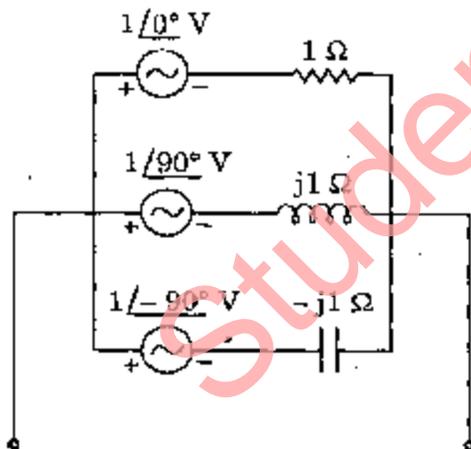
Replace the above shown circuit by a single voltage source in series with an impedance.

(a) 2 V, 1 Ω

(b) 1 V, 3 Ω

(c) 3 V, 1 Ω

(d) 2 V, 3 Ω

19. A barium titanate crystal has a thickness of 2 mm. Its voltage sensitivity is 12×10^{-3} Vm/N. It is subjected to a pressure of 0·5 MN/m². What is the voltage generated ?

(a) 3 V

(b) 6 V

(c) 5 V

(d) 12 V

20.
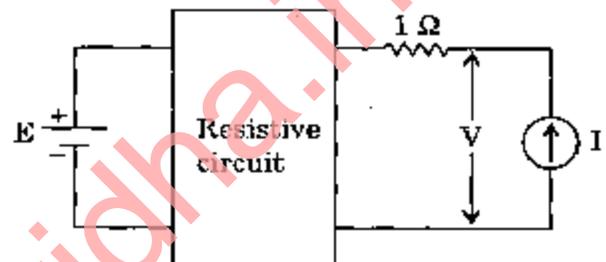
For the circuit as shown above, if $E = E_1$ and I is removed, then V = 5 volts. If E = 0 and I = 1 A, then V = 5 volts. For $E = E_1$ and I replaced by a resistor of 5 Ω, what is the value of V in volts ?

(a) 5·0

(b) 2·5

(c) 7·5

(d) 3·5

21. The impulse response of a second-order under-damped system started from rest is given by :

$$C(t) = 12·5\ e^{-6t} \sin 8t, \quad t \geq 0$$

What are the natural frequency and the damping factor of the system respectively ?

(a) 10 and 0·6

(b) 10 and 0·8

(c) 8 and 0·6

(d) 8 and 0·8

22. What will be the type of the system, if the steady state performance of control system yields a non-zero finite value of the velocity error constant ?

    (a) type – 0

    (b) type – 1

    (c) type – 2

    (d) type – 3

23. On which of the following factors does hysteresis loss *not* depend ?

    (a) Magnetic field intensity

    (b) Frequency of the field

    (c) Volume of the material

    (d) Neal temperature

24. A strain gauge having a resistance of 500 ohm and a gauge factor 3·0 is bonded on a member of structure undergoing tensile stress. If the change in resistance of the gauge is accurately measured as 1·5 ohm, what is the value of strain suffered by the member ?

    (a) 0·01

    (b) 0·001

    (c) 0·1

    (d) 0·003

25.
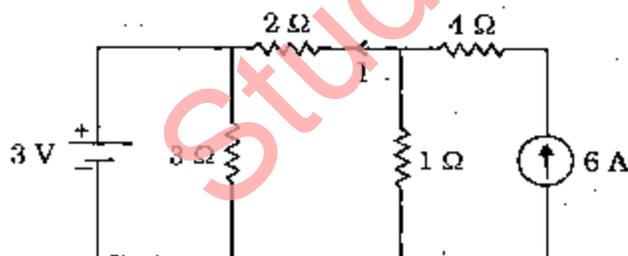
    For the circuit as shown above, what is the value of I ?

    (a) 4 A

    (b) 3 A

    (c) 2 A

    (d) 1 A

26. Dissipation factor, $\tan \delta$, of a capacitor is measured by which bridge ?

    (a) Anderson bridge

    (b) Hay bridge

    (c) Schering bridge

    (d) Wien bridge

27. The characteristic equation of a feedback control system is given by :

    $$s^3 + 6s^2 + 9s + 4 = 0$$

    What is the number of roots in the left-half of the s-plane ?

    (a) Three

    (b) Two

    (c) One

    (d) Zero

28. Which one of the following is *not* a Maxwell's equation ?

    (a) $\nabla \times H = (\sigma + j\omega\varepsilon) E$

    (b) $F = Q(E + v \times B)$

    (c) $\oint_C H \cdot ds = \int_s J \cdot ds + \int_s \frac{\partial D}{\partial t} \cdot ds$

    (d) $\oint_s B \cdot ds = 0$

29. The unit step response of a system is $[1 - e^{-t}(1 + t)] u(t)$. What is the nature of the system in turn of stability ?

    (a) Unstable

    (b) Stable

    (c) Critically stable

    (d) Oscillatory

30. A D'Arsonval galvanometer, 1 mA, 50 ohm is to be converted to a 5 Amp-ammeter. What is the value of the shunt resistor, R_{sh} ?

    (a) 10 ohm

    (b) 1 ohm

    (c) 0·01 ohm

    (d) 100 ohm

31.
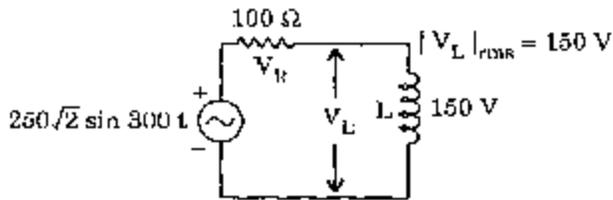
Consider the following, with respect to the circuit as shown above :

1. $V_R = 100\sqrt{2}$ V

2. $|I|_{rms} = 2$ A

3. $L = 0.25$ H

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 and 3

(c) 1 and 3

(d) 1 and 2

32. Consider the following statements in connection with boundary relations of electric field :

1. In a single medium electric field is continuous.

2. The tangential components are the same on both sides of a boundary between two dielectrics.

3. The tangential electric field at the boundary of a dielectric and a current carrying conductor with finite conductivity is zero.

4. Normal component of the flux density is continuous across the charge-free boundary between two dielectrics.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1, 2 and 3

(c) 1, 2 and 4

(d) 3 and 4 only

33. Consider the following :

1. Phase margin

2. Gain margin

3. Maximum overshoot

4. Bandwidth

Which of the above are the frequency domain specifications required to design a control system ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 3 and 4

(d) 1, 2 and 4

34. A 0 to 300 V voltmeter has an error of ± 2% of fsd. What is the range of readings if true voltage is 30 V ?

(a) 24 V – 36 V

(b) 20 V – 40 V

(c) 29·4 V – 30·6 V

(d) 20 V – 30 V

35. A network function $Z(s) = \dfrac{V(s)}{I(s)}$ has a single pole at $s = -\dfrac{1}{\sqrt{3}}$ and a single zero $s = -\sqrt{3}$.

If the excitation $v(t) = \sin t$, then what is the angle of lead or lag of the current ?

(a) Lead the voltage by 30°

(b) Lag the voltage by 30°

(c) Lead the voltage by 90°

(d) Lag the voltage by 90°

36. Magnetically hard materials do *not* possess which of the following characteristics ?

   (a) High retentivity

   (b) High coercivity

   (c) Strong magnetic reluctance

   (d) Zero differential permeability

37. In a digital voltmeter, the oscillator frequency is 400 kHz. The ramp voltage falls from 8 V to 0 V in 20 ms. What is the number of pulses counted by the counter ?

   (a) 8000

   (b) 4000

   (c) 3200

   (d) 1600

38. If the current flowing through a 20 ohm resistor is given as,
   $i(t) = 4 + 5 \sin \omega t - 3 \cos 3 \omega t$ amp, then what is the power consumed by the resistor ?

   (a) 1000 W

   (b) 660 W

   (c) 500 W

   (d) 180 W

39. What is the error in magnitude at the corner frequency for an asymptotic Bode magnitude plot for the term $(1 + s\tau)^{\pm n}$?

   (a) $\pm$ 20 n db

   (b) $\pm$ 6 n db

   (c) $\pm$ 3 n db

   (d) $\pm$ 1 n db

40. Quartz and $BaTiO_3$ exhibit which of the following properties ?

   (a) Magnetostriction

   (b) Ferromagnetism

   (c) Piezoelectricity

   (d) Ferroelectricity

41.
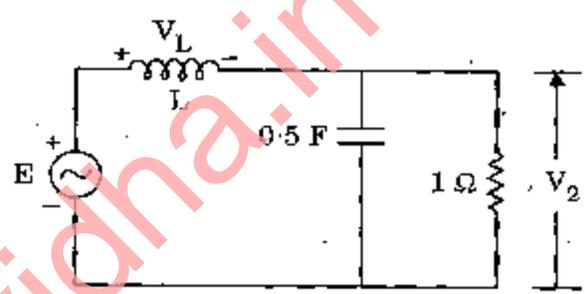
For the above given circuit, if supply frequency, $\omega = 2$ rad/sec and $V_2 = 2 \angle 0°$ volts, then what is the lead angle of V_L with V_2 ?

   (a) 15°

   (b) 45°

   (c) 90°

   (d) 135°

42. A long straight wire carries a current $I = 1$ A. At what distance is the magnetic field 1 Am^{-1} ?

   (a) 1·59 m

   (b) 0·159 m

   (c) 0·0159 m

   (d) 0·00159 m

43. A human nerve cell has an open circuit voltage of 80 mV and it can deliver a current of 5 nA through a 6 M ohm load. What is the maximum power available from the cell ?

(a) 0·16 nW

(b) 16 mW

(c) 1·6 W

(d) 16 pW

44. What is the slope of the line due to $\frac{1}{j\omega}$ factor in magnitude part of Bode plot ?

(a) – 20 db per octave

(b) – 10 db per octave

(c) – 6 db per octave

(d) – 2 db per octave

45. The poles and zeroes of a driving point impedance function, z(s) are as

Poles 0, –2

Zeroes –1, –3

and z $(\infty) = 4$

then what is z(s) ?

(a) $\frac{(s^2 + 2s)}{(2s^2 + 8s + 6)}$

(b) $\frac{(2s^2 + 4s)}{(s^3 + 4s + 3)}$

(c) $\frac{(s^2 + 4s + 3)}{(s^2 + 2s)}$

(d) $\frac{(4s^2 + 16s + 12)}{(s^2 + 2s)}$

46. Consider the following :

1. Human errors

2. Improper application of instruments

3. Error due to worn parts of an instrument

4. Errors due to effects of environment

Which of the above come under the type of systematic errors ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

47. Which one of the following statements is correct for the open-loop transfer function ?

$$G(s) = \frac{K(s + 3)}{s(s - 1)} \text{ for } K > 1$$

(a) Open-loop system is stable but the closed-loop system is unstable.

(b) Open-loop system is unstable but the closed-loop system is stable.

(c) Both open-loop and closed-loop systems are unstable.

(d) Both open-loop and closed-loop systems are stable.

48. Consider the following driving point immittance functions :

1. $z(s) = \dfrac{Ks(s^2+6)}{(s^2+2)(s^2+4)}$

2. $z(s) = \dfrac{(s^5+3s^3+5s)}{(3s^4+6s^2)}$

3. $z(s) = \dfrac{K(s^2+4)(s^2+9)}{(s^2+2)(s^2+6)}$

4. $z(s) = \dfrac{K(s^2+4)(s^2+9)}{s(s^2+6)}$

Which of these are LC immittance functions ?

(a) 1 and 2

(b) 3 and 4

(c) 2 and 3

(d) 4 only

49. For which one of the following materials, is the Hall coefficient zero ?

(a) Insulator

(b) Intrinsic semiconductor

(c) Metal

(d) Non-metal

50. Which one of the following describes correctly the effect of adding a zero to the system ?

(a) System becomes oscillatory

(b) Root locus shifts toward imaginary axis

(c) Relative stability of the system increases

(d) Operating range of K for stable operation decreases

51. What is the generalized Maxwell's equation $\nabla \times \overline{H} = \overline{J}e + \dfrac{\partial \overline{D}}{\partial t}$ for free space ?

(a) $\nabla \times \overline{H} = 0$

(b) $\nabla \times \overline{H} = \overline{J}e$

(c) $\nabla \times \overline{H} = \dfrac{\partial \overline{D}}{\partial t}$

(d) $\nabla \times \overline{H} = \overline{D}$

52. Which one of the following is a frequency sensitive bridge ?

(a) De-Sauty bridge

(b) Schering bridge

(c) Wien's bridge

(d) Maxwell's bridge

53. Root locus of $s(s+2) + K(s+4) = 0$ is a circle. What are the co-ordinates of the centre of this circle ?

(a) $-2, 0$

(b) $-3, 0$

(c) $-4, 0$

(d) $-5, 0$

54. In a three-phase, balanced, delta connected system, each phase voltage contains a fundamental, a third harmonic and a fifth harmonic of RMS values : 100 V, 30 V and 20 V respectively. What is the RMS value of the line-to-line voltage ?

(a) $\sqrt{100^2+30^2+20^2}$

(b) $\sqrt{3} \times \sqrt{100^2+30^2+20^2}$

(c) $\sqrt{100^2+20^2}$

(d) $\sqrt{3} \times \sqrt{100^2+20^2}$

55. Magnetic field intensity is

$$\vec{H} = 3\vec{a}_X + 7y\vec{a}_Y + 2x\vec{a}_Z \text{ A/m.}$$

What is the current density $\vec{J}$ A/m^2 ?

(a) $-2\vec{a}_Y$

(b) $-7\vec{a}_Z$

(c) $3\vec{a}_X$

(d) $12\vec{a}_Y$

56. Consider the following statements :

1. Bandwidth is increased.

2. Peak overshoot in the step response is increased.

Which of these are the effects of using lead compensation in a feedback system ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

57. If the bandwidth of an oscilloscope is given as direct current to 10 MHz, what is the fastest rise time a sine wave can have to be produced accurately by the oscilloscope ?

(a) 35 nsec

(b) 10 nsec

(c) 3·5 nsec

(d) 0·035 nsec

58. How much current must flow in a loop of radius 1 m to produce a magnetic field of 1 mAm^{-1} ?

(a) 1·0 mA

(b) 1·5 mA

(c) 2·0 mA

(d) 2·5 mA

59. What is represented by state transition matrix of a system ?

(a) Free response

(b) Impulse response

(c) Step response

(d) Forced response

60.
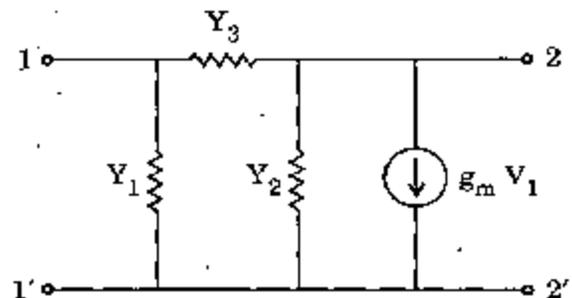
For the z-port network as shown above, what is the value of Y_{21} parameter ?

(a) $Y_1 + Y_3$

(b) $g_m - Y_2$

(c) $g_m - Y_3$

(d) $Y_1 + Y_2 + g_m$

61.
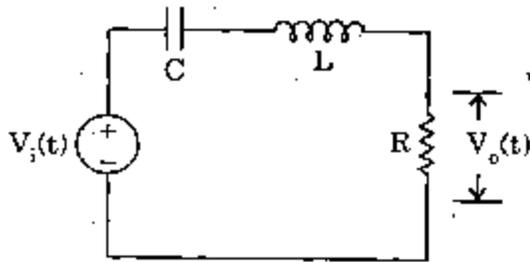
For the above shown network, the function

$G(s) = \dfrac{V_o(s)}{V_i(s)}$ is $\dfrac{4s}{s^2 + 4s + 20}$ when R is

2 ohm. What is the value of L and C ?

(a) 0·3 H and 1 F

(b) 0·4 H and 0·5 F

(c) 0·5 H and 0·1 F

(d) 0·5 H and 0·01 F

62. The system matrix of a linear time invariant continuous time system is given by

$A = \begin{bmatrix} 0 & 1 \\ -3 & -5 \end{bmatrix}$. What is the characteristic

equation ?

(a) $s^2 + 5s + 3 = 0$

(b) $s^2 - 3s - 5 = 0$

(c) $s^2 + 3s + 5 = 0$

(d) $s^2 + s + 2 = 0$

63.
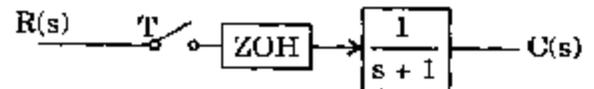
What is the transfer function $\dfrac{C(Z)}{R(Z)}$ of the sampled data system as shown above ?

(a) $\dfrac{(1 - e^{-T})}{(Z - e^{-T})}$

(b) $\dfrac{(Z - e^{-T})}{(1 - e^{-T})}$

(c) $\dfrac{(1 - 2e^{-T})}{(e^{-T} - Z)}$

(d) $\dfrac{(1 - 2Ze^{-T})}{(Z - 1)}$

64.
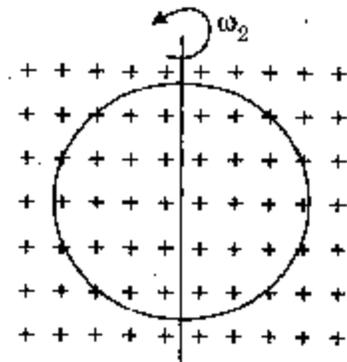
A circular loop placed perpendicular to a uniform sinusoidal magnetic field of frequency ω_1 is revolved about an axis through its diameter at an angular velocity ω_2 rad/sec ($\omega_2 < \omega_1$) as shown in the figure above. What are the frequencies for the e.m.f. induced in the loop ?

(a) ω_1 and ω_2

(b) ω_1, $\omega_1 + \omega_2$ and ω_2

(c) ω_2, $\omega_1 - \omega_2$ and ω_2

(d) $\omega_1 - \omega_2$ and $\omega_1 + \omega_2$

65.
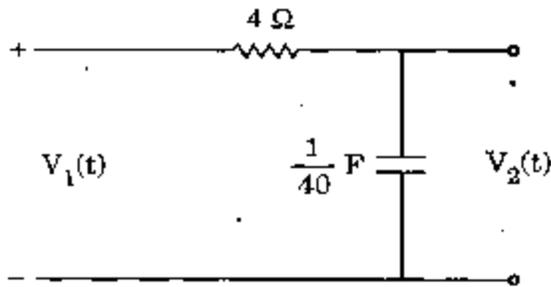
Consider the following with respect to the above circuit :

1. The transfer function of the circuit is $\frac{10}{s+10}$.

2. If $V_1(t) = 20$, $V_2(t) = 20(1 - e^{-10t})$.

3. If $V_1(t) = 20 \sin 10t$,
$$V_2(s) = \frac{2000}{(s+10)(s^2+100)}.$$

Which of these is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 1, 2 and 3

(d) 2 only

66. What is the initial slope of Bode magnitude plot of a type-2 system ?

(a) -20 db/decade

(b) $+20$ db/decade

(c) -40 db/decade

(d) $+40$ db/decade

67. In free space
$$\overline{E}(Z, t) = 120\,\pi \cos(\omega t - \beta Z)\,\overline{a}_x \text{ Vm}^{-1}.$$
What is the average power in Wm^{-2} ?

(a) $30\pi\,\overline{a}_Z$

(b) $60\pi\,\overline{a}_Z$

(c) $90\pi\,\overline{a}_Z$

(d) $120\pi\,\overline{a}_Z$

68.
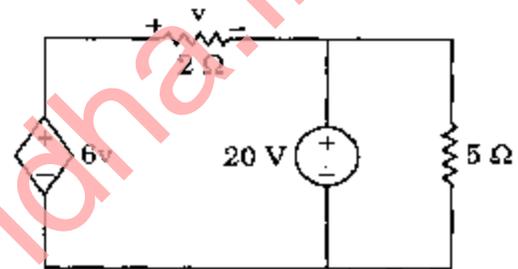
What is the current through the $2\,\Omega$ resistance for the circuit as shown above ?

(a) 5 A

(b) 4 A

(c) 3 A

(d) 2 A

69. The open-loop transfer function of a system has one pole in the right half of s-plane. If the system is to be closed loop stable, then $(-1 + j0)$ point should have how many encirclements in the GH-plane ?

(a) -2

(b) -1

(c) $+1$

(d) $+2$

70. Consider the following statements in connection with cylindrical waveguides :

1. At low frequency the propagation constant is real and wave does not propagate.

2. At intermediate frequency the propagation constant is zero and wave cuts off.

3. At high frequency the propagation constant is imaginary and wave propagates.

4. At transition condition the cut-off frequency is inversely proportional to the eigen values of the Bessel function for the respective TE_{nr} mode.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 2 only

(c) 2 and 3 only

(d) 2, 3 and 4

71.
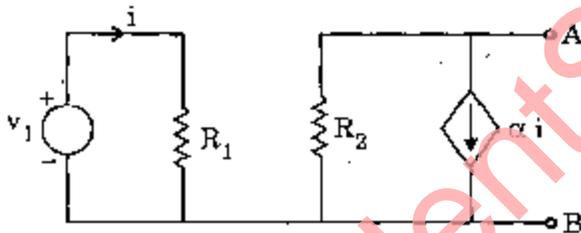
For the circuit as shown above, what are the values of the Norton's equivalent current and conductance between AB terminals ?

(a) $\alpha \dfrac{v_1}{R_1}$ and $G = \dfrac{1}{R_2}$

(b) $\alpha \dfrac{v_1}{R_2}$ and $G = \dfrac{1}{R_1}$

(c) $\alpha \dfrac{v_1}{R_1}$ and $G = \dfrac{1}{R_2}$

(d) $-\alpha \dfrac{v_1}{R_1}$ and $G = -\dfrac{1}{R_1}$

72. A 100 kV, 50 Hz supply is fed to a rectifier ammeter (using a bridge rectifier) through a capacitor. The PMMC ammeter of the rectifier instrument reads 45×10^{-3} Amp. What is the value of the capacitor ?

(a) $15 \cdot 90 \times 10^{-10}$ F

(b) $15 \cdot 90 \times 10^{-12}$ F

(c) $17 \cdot 66 \times 10^{-9}$ F

(d) $17 \cdot 66 \times 10^{-11}$ F

73.
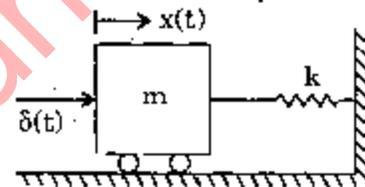
A mechanical system is as shown in the figure above. The system is set into motion by applying a unit impulse force $\delta(t)$. Assuming that the system is initially at rest and ignoring friction, what is the displacement $x(t)$ of mass ?

(a) $\dfrac{1}{\sqrt{k}} \exp(-m \cdot t)$

(b) $\dfrac{1}{\sqrt{mk}} \sin(t)$

(c) $\dfrac{1}{\sqrt{mk}} \sin\left(\sqrt{\dfrac{k}{m}} \cdot t\right)$

(d) $\dfrac{1}{\sqrt{mk}}\left(\sqrt{\dfrac{k}{m}} \cdot t\right)$

74.
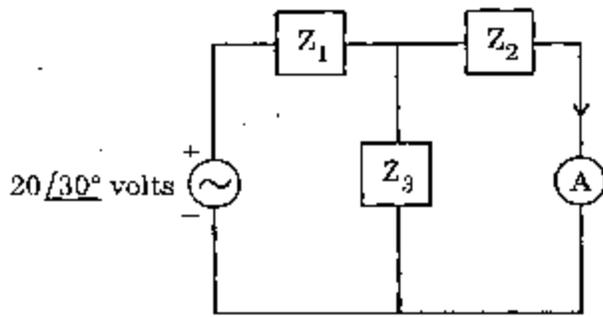
Fig. (a)
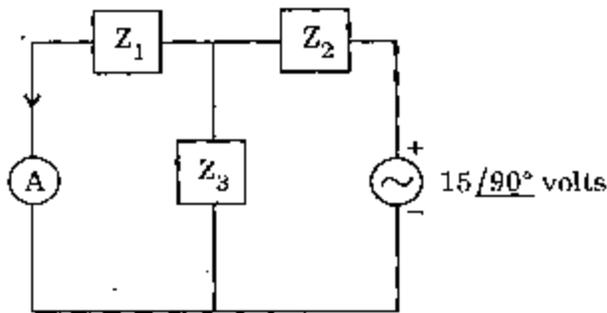
Fig. (b)

For the circuit as shown in Fig. (a), the current through the ammeter is $4 \angle -45°$ Amps. What is the current in the ammeter for the circuit in Fig. (b) ?

(a) $3 \angle 15°$ Amps

(b) $2 \angle 30°$ Amps

(c) $4 \angle 45°$ Amps

(d) $5 \angle -90°$ Amps

75. The electric field of a uniform plane wave is given by :

$$\overline{E} = 10 \sin (3\pi \times 10^8 t - \pi Z) \overline{a}_X +$$
$$10 \cos (3\pi \times 10^8 t - \pi Z) \overline{a}_Y \ Vm^{-1}.$$

What is the corresponding magnetic field $\overline{H}$?

(a) $\dfrac{10}{377} \sin (3\pi \times 10^8 t - \pi Z) \overline{a}_Y +$
$\dfrac{10}{377} \cos (3\pi \times 10^8 t - \pi Z) (-\overline{a}_X) \ Am^{-1}$

(b) $\dfrac{10}{377} \sin (3\pi \times 10^8 t - \pi Z) (-\overline{a}_Y) +$
$\dfrac{10}{377} \cos (3\pi \times 10^8 t - \pi Z) (-\overline{a}_X) \ Am^{-1}$

(c) $\dfrac{10}{377} \sin (3\pi \times 10^8 t - \pi Z) \overline{a}_Y +$
$\dfrac{10}{377} \cos (3\pi \times 10^8 t - \pi Z) (\overline{a}_X) \ Am^{-1}$

(d) $\dfrac{10}{377} \sin (3\pi \times 10^8 t - \pi Z) (-\overline{a}_Y) +$
$\dfrac{10}{377} \cos (3\pi \times 10^8 t - \pi Z) (\overline{a}_X) \ Am^{-1}.$

76.

R ⟶ [G] ⟶ ⊗ ⟶ E
                ↑
                C
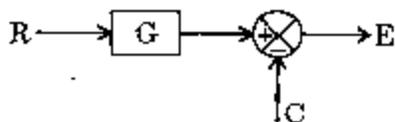
Which one of the following block diagrams is equivalent to the above shown block diagram ?

(a) R ⟶ ⊗ ⟶ [G] ⟶ E
          ↑
          C

(b) R ⟶ ⊗ ⟶ [G] ⟶ E
          ↑
          [1/G] ← C

(c) R ⟶ ⊗ ⟶ E
          ↑
          [G] ← C

(d) R ⟶ ⊗ ⟶ E
          ↑
          [1/G] ← C
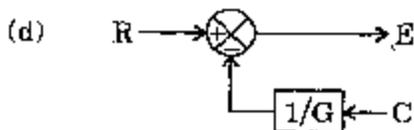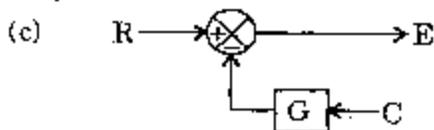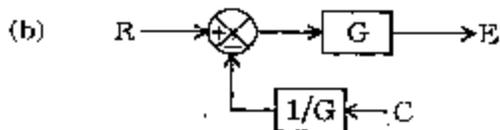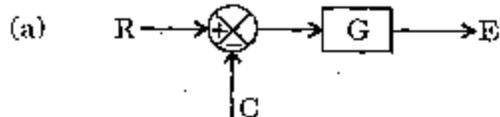
77.

What is the voltage across the current source for the above shown circuit ?

(a) 5·0 V

(b) 7·5 V

(c) 12·5 V

(d) 17·5 V

78. Consider the following statements :

In a Hall effect experiment, the sign of Hall voltage will change if

1. Direction of applied field is changed.

2. Direction of applied magnetic field is changed.

3. Direction of both applied electric and magnetic fields are changed.

4. Direction of current is changed.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 3 only

(c) 1, 2 and 4

(d) 3 and 4

79. Consider the following statements in connection with electromagnetic waves :

1. Conducting medium behaves like an open circuit to the electromagnetic field.

2. At radio and microwave frequencies the relaxation time is much less than the period.

3. In loss-less dielectric the relaxation time is infinite.

4. Intrinsic impedance of a perfect dielectric medium is a pure resistance.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 2, 3 and 4

80.
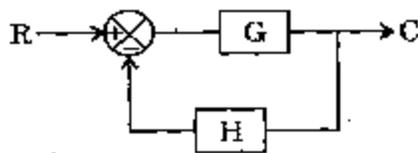
The above shown feedback control system has to be reduced to equivalent unity feedback system. Which one of the following is equivalent ?

(a)

(b)

(c)

(d)
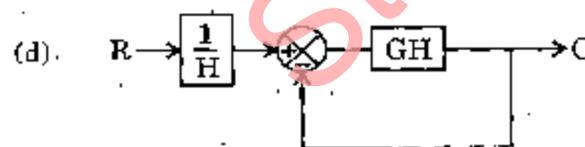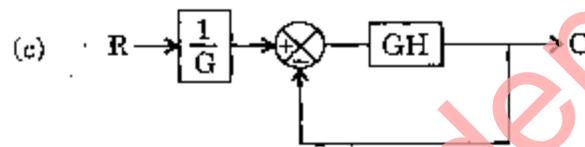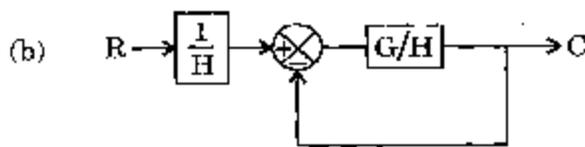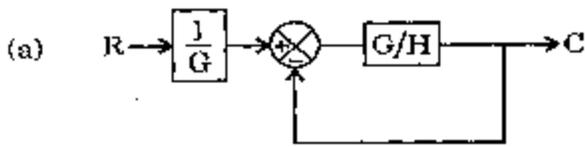
81.
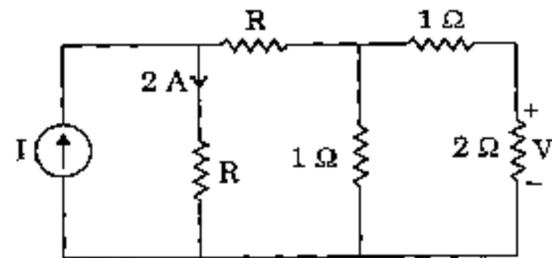
What is the value of I for the above shown circuit, if V = 2 volts ?

(a) 2 A

(b) 4 A

(c) 6 A

(d) 8 A

82. In semiconductor strain gauges, what happens when a tensile strain is applied ?

(a) Resistance increases in N-type of materials

(b) Resistance increases in P-type of materials

(c) Resistance increases in both P and N-type of materials

(d) Resistance decreases in both P and N-type of materials

83. For intrinsic GaAs, the room-temperature electrical conductivity is 10^{-6} (ohm-m)$^{-1}$, the electron and hole mobilities are, respectively, 0·85 and 0·04 m^2/V-s. What is the intrinsic carrier concentration n_i at the room temperature ?

(a) 10^{21} m^{-3}

(b) 10^{-20} m^{-3}

(c) $7·0 \times 10^{+12}$ m^{-3}

(d) $7·0 \times 10^{-20}$ m^{-3}

84. A second order system has a natural frequency of oscillations of 3 rad/sec and damping ratio of 0·5. What are the values of resonant frequency and resonant peak of the system ?

(a) 1·5 rad/sec and 1·16

(b) 1·16 rad/sec and 1·5

(c) 1·16 rad/sec and 2·1

(d) 2·1 rad/sec and 1·16

85. A transmission line of characteristic impedance of 50 ohm is terminated by a load impedance of $(15 - j20)$ ohm. What is the normalized load impedance ?

(a) $0·6 - j0·8$

(b) $0·8 - j0·6$

(c) $0·3 - j0·4$

(d) $0·3 + j0·4$

86. The response of an initially relaxed, linear constant-parameter network to a unit impulse applied at $t = 0$ is $4e^{-2t}\,u(t)$. What is the response of this network to unit step function ?

(a) $2(1 - e^{-2t})\,u(t)$

(b) $4(e^{-t} - e^{-2t})\,u(t)$

(c) $\sin 2t$

(d) $(1 - 4e^{-4t})\,u(t)$

87.
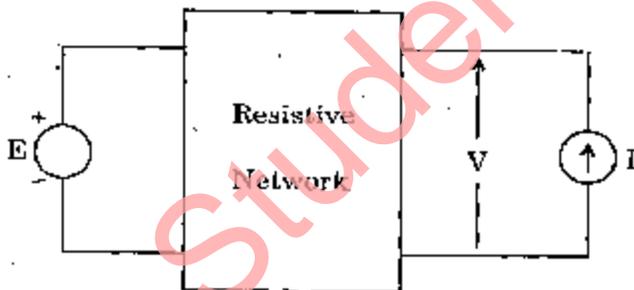
In the above shown circuit, if V = 3 volts for E = 1 volt, I = 0; and V = 2 volts for I = 2 A and E = 0. When E = 1 volt and I is replaced by a resistor of 2 ohm, then what is the value of V ?

(a) 2 volts

(b) 4 volts

(c) 6 volts

(d) 8 volts

88. For a certain thermistor, the material constant (β) is 3000 kelvin and its resistance at 27° C is 1050 ohm. What is the temperature coefficient of resistances for this thermistor ?

(a) $0·033 \times 10^{-3}$ ohm/ohm/°C

(b) $- 0·033$ ohm/ohm/°C

(c) $- 3·33$ ohm/ohm/°C

(d) $- 3·0$ ohm/ohm/°C

89. Consider the following statements :

1. A system is said to be stable if its output is bounded for any input.

2. A system is stable if all the roots of the characteristic equation lie in the left half of the s-plane.

3. A system is stable if all the roots of the characteristic equation have negative real parts.

4. A second order system is always stable for finite positive values of open loop gain.

Which of the above statements is/are correct ?

(a) 2, 3 and 4

(b) 1 only

(c) 2 and 3 only

(d) 3 and 4 only

**90.**
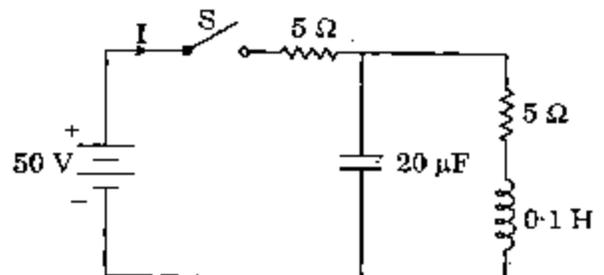
The network shown above is initially at rest. What is the initial current I when the switch S is closed at $t = 0$?

(a) 0 A

(b) 5 A

(c) 10 A

(d) 20 A

91.

2 Z   line A

Z/2   line B
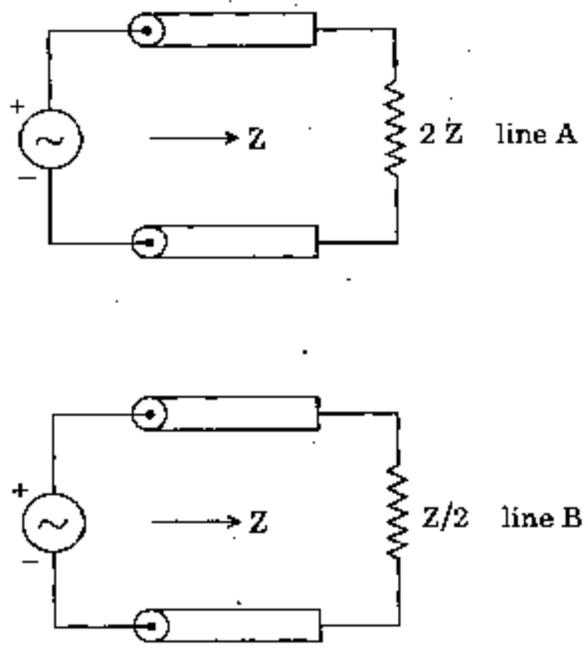
Two loss-less resistive transmission lines each of characteristic impedance Z are connected as shown in the circuits above. If the maximum voltage on the two lines is the same and the power transmitted by line A is W_1, then what is the power transmitted by the line B ?

(a)   4 W_1

(b)   3 W_1

(c)   2 W_1

(d)   1 W_1

92. The open loop transfer function of a closed loop control system is given as :

$G(s) H(s) = \dfrac{K(s+2)}{s(s+1)(s+4)^2}$. What are the number of asymptotes and the centroid of the asymptotes of the root-loci of closed loop system ?

(a) -3; $\left(\dfrac{7}{3},\ 0\right)$

(b) -2; $(2, 0)$

(c) 3; $\left(\dfrac{-7}{3},\ 0\right)$

(d) 2; $(-2, 0)$

93.
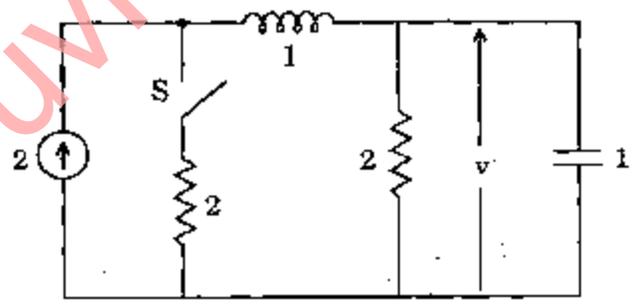
The circuit as shown above is in the steady state. The switch S is closed at $t = 0$. What are the values of v and $\dfrac{dv}{dt}$ at $t = 0^+$?

(a)   0 and 4

(b)   4 and 0

(c)   2 and 0

(d)   0 and 2

94. The transfer function of a phase-lead compensator is given by :

$$G(s) = \frac{1+3Ts}{1+Ts}$$ where $T > 0$. What is the maximum shift provided by such a compensator ?

(a) 90°

(b) 60°

(c) 45°

(d) 30°

95.
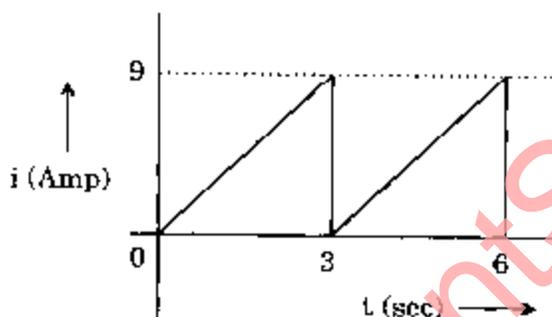
The current waveform as shown above, is applied in a pure resistor of 10 Ω. What is the power dissipated in the resistor ?

(a) 270 W

(b) 135 W

(c) 52 W

(d) 7 W

96. Consider the following statements :

1. A phase lead network provides a positive phase angle over the frequency range of interest.

2. Armature controlled d.c. servo motor is inherently a closed-loop system.

3. Phase lag network provides significant amplification over the frequency range of interest.

4. Transfer functions with zeroes in the right half of s-plane is a non-minimum system.

Which of the above statements is/are correct ?

(a) 3 only

(b) 1 and 2 only

(c) 1, 2 and 4

(d) 2, 3 and 4

97.
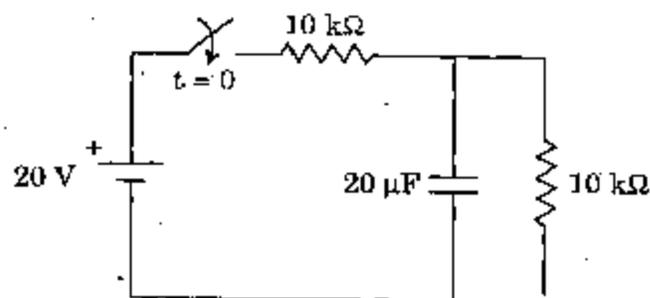
The switch of above circuit was open for long, and at t = 0 it is closed. What is the final steady state voltage across the capacitor and the time-constant of the circuit ?

(a) 0 V and 0·1 sec

(b) 20 V and 0·2 sec

(c) 10 V and 0·2 sec

(d) 10 V and 0·1 sec

98. A linear system is described by the following state equations :

$$\dot{X}(t) = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix} X + \begin{bmatrix} 2 \\ 0 \end{bmatrix} Y$$

$$Y(t) = \begin{bmatrix} 0 & 3 \end{bmatrix} X$$

What is the transfer function of the system ?

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

(b) $\dfrac{6}{s^2 + 3s + 2}$

(c) $\dfrac{6}{s^2 + 2s + 3}$

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

99. A transmission line section shows an input impedance of 36 Ω and 64 Ω respectively, when short circuited and open circuited. What is the characteristic impedance of the transmission line ?

(a)   100 Ω

(b)   50 Ω

(c)   45 Ω

(d)   48 Ω

100. The poles and zeroes of an all-pass network are located in which part of the s-plane ?

(a)   Poles and zeroes are in the right half of s-plane

(b)   Poles and zeroes are in the left half of s-plane

(c)   Poles in the right half and zeroes in the left half of s-plane

(d)   Poles in the left half and zeroes in the right half of s-plane

101. When a transfer function model is converted into state space model, the order of the system may be reduced during which one of the following conditions ?

(a)   Some of the variables are not considered

(b)   Some of the variables are hidden

(c)   Pole, zero cancellation takes place

(d)   The order of the system will never get changed

102. How can the power supplied to a high frequency heating system be measured ?

(a)   By dynamometer wattmeter

(b)   By induction wattmeter

(c)   By thermocouple type wattmeter

(d)   By moving iron ammeter and voltmeter

103. In an RLC series resonant circuit, if the maximum stored energy is increased by 10% and at the same time the energy dissipated per cycle is reduced by 10%, it will result in which one of the following ?

(a) An 11% decrease in quality factor

(b) An increase in the resonant frequency by 11%

(c) A 22% increase in quality factor

(d) A decrease in the resonant frequency by 22%

104. If D is the rotor diameter and L, the axial length, then a high performance a.c. servomotor is characterized by which one of the following ?

(a) Large D and Large L

(b) Large D and Small L

(c) Small D and Small L

(d) Small D and Large L

105. Why is the network function,

$N(s) = \dfrac{s^3 + 3s}{s^4 + 4s^2 + 4}$ **not** positive real ?

(a) The highest degree of numerator and denominator polynomials differ by one

(b) The terms of the lowest degree in the numerator and denominator polynomials differ in degree by one

(c) The poles and zeroes have zero real parts

(d) It has multiple poles on the imaginary axis

106. Consider the following statements with reference to hydraulic systems :

1. A small size actuator can develop a very large force or torque.

2. A source with supply and return line is required.

3. It is insensitive to temperature changes.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 1 and 2

(d) 2 and 3

107.
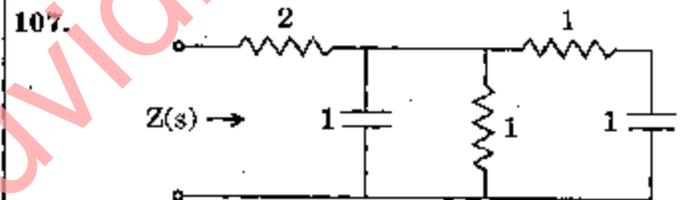
The network realization of RC impedance function, $Z(s) = \dfrac{(\alpha s^2 + 7s + 3)}{(s^2 + 3s + \beta)}$ is as shown above. What are the values of α and β ?

(a) 1 and 2

(b) 2 and 1

(c) 2 and 3

(d) 3 and 2

108. Which one of the following is **not** the criterion used to select potentiometer in a control system ?

(a) Accuracy

(b) Noise

(c) Time response

(d) Frequency response

109.
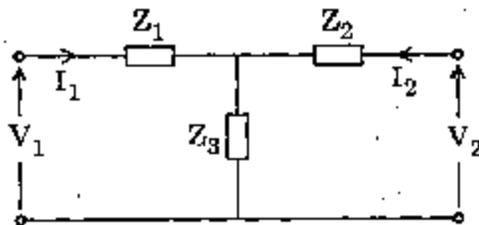
If the Z-parameters for the T-network as shown above are $Z_{11} = 40\ \Omega$, $Z_{22} = 50\ \Omega$ and $Z_{12} = Z_{21} = 30\ \Omega$, then what are the values of Z_1, Z_2 and Z_3 ?

(a) $10\ \Omega$, $20\ \Omega$ and $30\ \Omega$

(b) $20\ \Omega$, $30\ \Omega$ and $20\ \Omega$

(c) $30\ \Omega$, $40\ \Omega$ and $10\ \Omega$

(d) $40\ \Omega$, $50\ \Omega$ and $10\ \Omega$

Directions : Each of the next eleven (11) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is **not** the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

110. *Assertion (A) :* The semiconductor material used in making an optical source should be a direct bandgap material.

Reason (R) : Carrier recombination time is shorter in a direct bandgap semiconductor.

111. *Assertion (A) :* A capacitor has one pole at s = infinity and one zero at s = 0, where s = jω, ω is the angular frequency.

Reason (R) : The driving point impedance of a capacitor is $\dfrac{1}{Sc}$.

112. *Assertion (A) :* To increase the range of an ammeter to measure high currents, it is required to connect a high resistor in shunt across the ammeter.

Reason (R) : The shunt resistor will divert the excess current and allow only the rated current to pass through the deflecting system of the ammeter.

113. *Assertion (A) :* The sensitivity of a voltmeter is often expressed in terms of ohms-per-volt.

Reason (R) : High sensitivity voltmeters use a basic d'Arsonval meter which has high sensitivity.

114. *Assertion (A) :* In a bridge type of measurement, it is required that the indicator used to show the balance condition of the bridge should have very high sensitivity.

Reason (R) : The accuracy of the null-indicator does not play any role in a bridge measurement.

115. *Assertion (A) :* An electronic millivoltmeter used to read very low a.c. voltages at high frequencies is an amplifier-rectifier type of meter.

Reason (R) : The diodes cannot rectify low a.c. voltages of millivolt order.

116. *Assertion (A) :* Electron beam switch is used in a multitrace CRO.

Reason (R) : Electron beam switch synchronizes the input signal and gives a steady waveform on the CRO screen.

117. *Assertion (A) :* Random errors can be minimized by statistical methods.

Reason (R) : These are caused by arithmetic error while taking readings.

118. *Assertion (A) :* The stator windings of a control transformer has higher impedance per phase.

Reason (R) : The rotor of a control transformer is cylindrical in shape.

119. *Assertion (A) :* Addition of a pole to the forward path transfer function of unity feedback system increases the rise time of step response.

Reason (R) : The additional pole has the effect of increasing the bandwidth of the system.

120. *Assertion (A) :* Knowing magnetic vector potential $\vec{A}$ at a point, the flux density $\vec{B}$ at that point can be obtained.

Reason (R) : $\vec{\nabla} \cdot \vec{A} = 0$.

O-FTF-J-FFA

(24 – A)

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

T.B.C. : O-FTF-J-FFB

Test Booklet Series

Serial No.

28373

TEST BOOKLET

A

ELECTRICAL ENGINEERING
Paper II

Time Allowed : Two Hours

Maximum Marks : 200

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). 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 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.

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

1. Consider the following tests :

   1. Load test

   2. Short circuit test

   3. OC test

   4. Retardation test

   Which of the above tests are to be conducted for the determination of voltage regulation of a transformer ?

   (a) 1 only

   (b) 2 only

   (c) 2 and 3

   (d) 3 and 4

2. A three phase 50 Hz, 11 kV and 37·5 MW at 0·9 p.f. capacity synchronous generator has its stator bore diameter of 765 cm and an axial core length of 80 cm. For which power plant this generator is suitable ?

   (a) Thermal coal fired plant

   (b) Hydroelectric power plant

   (c) Nuclear power plant

   (d) Pumped storage power plant

3. A transistor has a maximum power dissipation limit of 300 mW for ambient temperature up to 25°C. If the maximum allowable junction temperature is 175°C, then what is the limit of the device in an ambient temperature of 55°C ?

   (a) 120 mW

   (b) 240 mW

   (c) 300 mW

   (d) 360 mW

4. Which stack is used in 8085 microprocessors ?

   (a) FIFO

   (b) FILO

   (c) LIFO

   (d) LILO

5. An angle modulated signal is described by the equation

   $$x_c(t) = 10 \cos[2\pi f_c t + 10 \sin(4000\pi t) + 5 \sin 2000\pi t]$$

   What is the bandwidth of this modulated signal ?

   (a) 6 kHz

   (b) 45 kHz

   (c) 54 kHz

   (d) 63 kHz

6. If the turn on and turn off energy losses in a transmitter are 51 mJ and 76·8 mJ respectively and the mean power loss is limited to 200 W, what is the maximum switching rate that can be achieved ?

   (a) 15649 cycles/s

   (b) 156·49 cycles/s,

   (c) 1564·9 cycles/s

   (d) 15·649 cycles/s

7. The antenna current of an A.M. transmitter is 8 A when only carrier is sent, but it increases to 8·93 A when the carrier is modulated. Then what is the percentage modulation of the wave ?

   (a) 43·00%

   (b) 70·14%

   (c) 57·00%

   (d) 100·00%

8.
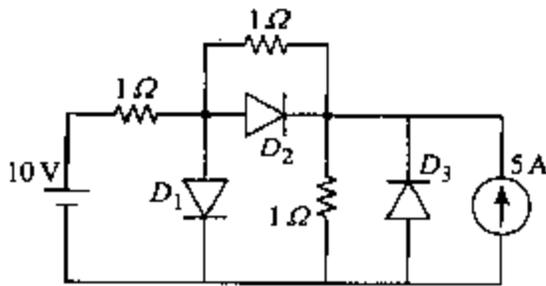
What are the states of the three ideal diodes in the circuit as shown above ?

	D_1	D_2	D_3
(a)	On	Off	Off
(b)	Off	On	Off
(c)	On	Off	On
(d)	Off	On	On

9. Number of thyristors, each with a rating of 500 V, 75 A, required in each branch of a series-parallel combination for a circuit with a total voltage and current ratings of 7·5 kV and 1 kA respectively. If the device derating factor is 14%, then what is the number of thyristors in series and parallel branch respectively ?

	No of thyristors in series branch	No of thyristors in parallel branch
(a)	18	16
(b)	15	14
(c)	12	12
(d)	16	18

10. Where is the draft tube of a hydropower station that is an airtight pipe located ?

(a) Near the surge tank

(b) In between the penstock and the runner

(c) In between the runner exhaust and the tailrace

(d) At the beginning of penstock

11. An F.M. signal which is modulated by a 4 kHz sine wave reaches a maximum frequency of 100·01 MHz and minimum frequency of 99·97 MHz, then what is the one side frequency deviation of the signal ?

(a) 6·67

(b) 5·00

(c) 10·0

(d) 20·0

12. What is the power transmitted inductively in an auto-transformer which supplies a load at 161 volts with an applied primary voltage of 230 volts ?

(a) 35% of the input

(b) 70% of the input

(c) 15% of the input

(d) 30% of the input

13. The starting current and torque of a three phase induction motor on direct line starting is 30 Amp and 300 Nm respectively. What are the corresponding values with star delta starter ?

(a) 10 A and 100 Nm

(b) 30 A and 300 Nm

(c) 17·32 A and 173·2 Nm

(d) 30 A and 173·3 Nm

3

14. Consider the following statements :

HVDC transmission is superior to HVAC transmission due to

1. Lack of reliable DC circuit breakers.

2. Lesser number of conductors for same power carrying capacity.

3. Non synchronous link between two different systems simplifying the problem of voltage stability and frequency control.

4. No costly terminal equipments such as converters and inverters are required.

Which of the above statements is/are correct ?

(a) 4 only

(b) 4 and 3

(c) 1 and 2

(d) 2 and 3

15.
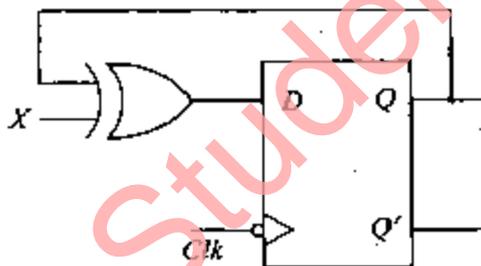
The digital circuit as shown above represents to which one of the following ?

(a) JK flip-flop

(b) Clocked RS flip-flop

(c) T flip-flop

(d) Ring counter

16. Consider the following :

1. Sign flag

2. Trap flag

3. Parity flag

4. Auxiliary carry flag

Which of the above flags is/are present in 8085 microprocessor ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 1, 3 and 4

17. Which one of the following is *not* a part of typical TV receiver ?

(a) Sweep signal generator

(b) Envelope detector

(c) Video amplifier

(d) Pre-emphasis circuit

18. The anode current through a conducting SCR is 10 A. If its gate current is made one-fourth, then what will be the anode current ?

(a) 0 A

(b) 5 A

(c) 10 A

(d) 20 A

19. What is the power transferred conductively from primary to secondary of an auto-transformer having transformation ratio of 0·8 supplying a load of 3 kW ?

(a) 0·6 kW

(b) 2·4 kW

(c) 1·5 kW

(d) 0·27 kW

20. Consider the following statements concerning steam power plants :

1. Maintenance and operating costs are low.

2. Water is required in huge quantity.

3. Requires long time for installation.

4. Handling of coal and disposal of ash can be done easily.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 and 3

(c) 3 only

(d) 3 and 4

21.
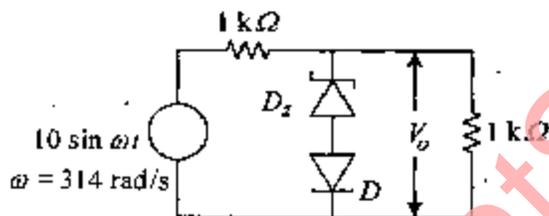
The cut-in voltage of zener diode D_z and diode D shown in the figure above is 0·7 V. Breakdown voltage of D_z is 3·3 V and reverse breakdown voltage of D is 50 V. The other parameters can be assumed to be the same as those of an ideal diode. Then what are the values of the peak output voltage. V_o ?

	Positive Half cycle in V	Negative Half cycle in V
(a)	3·3	1·4
(b)	4	5
(c)	3·3	3·3
(d)	4	4

22. Consider the following statements :

In 8085 microprocessor, data-bus and address-bus are multiplexed in order to

1. Increase the speed of microprocessor.

2. Reduce the number of pins.

3. Connect more peripheral chips.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 2 and 3

(d) 1, 2 and 3

23. In a power circuit of 3 kV, four thyristors each of rating 800 V are connected in series. What is the percentage series derating factor ?

(a) 50

(b) 25

(c) 12·5

(d) 6·25

24. What is the core loss in a high frequency ferrite core transformer used in SMPS power supply ?

(a) 10% of rated power

(b) 5% of rated power

(c) 2% of rated power

(d) 1% of rated power

25. Which one of the following is considered as an A.M. signal ?

(a) Binary phase shift keying (BPSK)

(b) Differential phase shift keying (DPSK)

(c) Differential encoded PSK

(d) Quadrature PSK

26. For 16 bit address-bus, if an 8K RAM chip is selected when, A_{13}, A_{14} and A_{15} address bits are all one, then what is the range of the memory address ?

(a) EOOOH – EFFFH

(b) EOOOH – FFFFH

(c) FOOOH – FFFFH

(d) FOOOH – FEEEH

27.
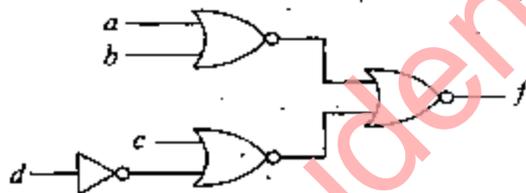
Which one of the following is the correct output (f) of the above circuit ?

(a) $(a+b)(c+\overline{d})$

(b) $(\overline{a}+\overline{b})(c+\overline{d})$

(c) $(a+\overline{b})(c+\overline{d})$

(d) $(a+b)(\overline{a}+\overline{d})$

28. The making and breaking currents of 3 phase ac circuit breakers in power system are respectively in what form ?

(a) r.m.s. value, r.m.s. value

(b) instantaneous value, r.m.s. value

(c) r.m.s. value

(d) instantaneous value, instantaneous value

29. A three phase 6 pole 50 Hz induction motor is running at 5% slip. What is the speed of the motor ?

(a) 850 rpm

(b) 900 rpm

(c) 950 rpm

(d) 1000 rpm

.30.
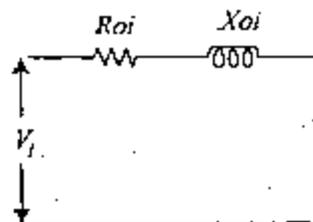
At which condition of the transformer the equivalent circuit will be as shown in the above figure ?

(a) Under short circuit

(b) Under open circuit

(c) Under no load

(d) Under rated load

31. What is the nominal pH value of water that is to be maintained in a steam raising thermal power station ?

(a) 0·0

(b) 7·0

(c) 8·5

(d) 14·3

32. Consider the following statements about a Tunnel diode :

1. Tunnelling takes place at a speed decided by junction temperature.

2. Concentration of impurities is of the order of 1 part in 10^3.

3. Both tunnelling current and normal pn junction injection current exist.

4. Tunnel diode exhibits current controlled negative resistance. characteristic, only.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 3 and 4

33. In an instruction of 8085 microprocessor, how many bytes are present ?

(a) One or two

(b) One, two or three

(c) One only

(d) Two or three

34. Which one of the following factors is limited in case of F.M. ?

(a) Maximum frequency deviation

(b) Maximum permissible modulation index

(c) Signal to noise voltage ratio

(d) Minimum permissible modulation index

35. Consider the following statements, with respect to the power transistors used in inverters :

1. Maximum collector-emitter voltage VcEo.

2. Maximum collector current.

3. Maximum power dissipation.

4. Maximum current gain at minimum load current.

5. Maximum current gain at maximum load current.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1, 2, 3 and 5

(c) 2 and 3 only

(d) 2, 3 and 4

36. When will a slip ring induction motor run at super synchronous speed ?

(a) If a voltage is injected in the rotor circuit in phase opposition to the rotor induced emf

(b) If an emf is injected in the rotor circuit in phase with the rotor induced emf

(c) If motor is coupled with active load

(d) If motor is coupled with passive load

7

37. Consider the following statements :

1. Present day surge diverters use non-linear resistance elements.

2. A travelling wave is usually represented as a step wave in the analysis.

3. A travelling wave suffers reflection when it reaches a discontinuity.

4. The function $(f(vx \pm t))$ represents a travelling wave.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2 only

(c) 1, 2 and 3

(d) 3 and 4 only

38.
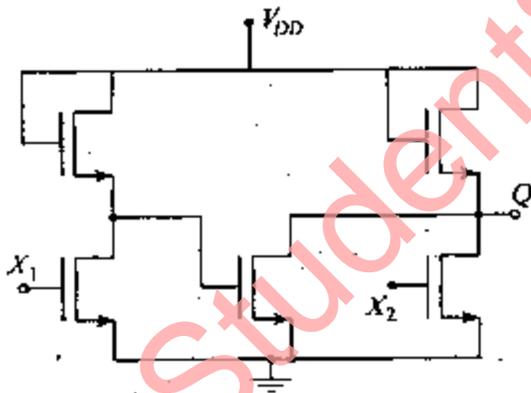
If X_1 and X_2 are the inputs to the circuit as shown in the above figure, then what is the output Q ?

(a) $(X_1 + X_2)'$

(b) $(X_1 - X_2)'$

(c) $(X_1 \cdot X_2)$

(d) $(X_1 \cdot X_2')$

39. To address the memory 14 bits are used. Then what is the address of the last memory location ?

(a) 16382

(b) 16383

(c) 16384

(d) 16385

40. Which one of the following modulation technique is most affected by noise ?

(a) ASK

(b) PSK

(c) FSK

(d) MSK

41. For elimination of 5th harmonics from the output of an inverter, what will be the position of pulse in a PWM inverter ?

(a) 72°

(b) 36°

(c) 60°

(d) 90°

42.
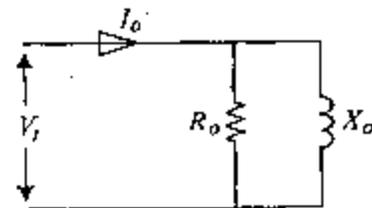
At which condition of the transformer the equivalent circuit will be as shown above ?

(a) Under short circuit

(b) Under rated load

(c) Under open circuit

(d) Under load and no load

43. Complete combustion of pulverized coal in a steam raising thermal power plant is ensured by what type of an analysis of flue gas going out by the chimney ?

(a) O_2 content for given air intake

(b) CO_2 content for given fuel rate feed

(c) CO content

(d) All of the above

44.
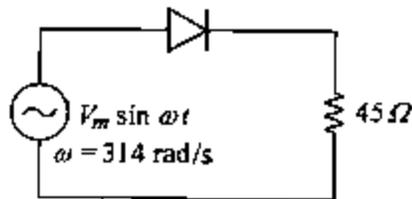
The forward resistance of the diode shown in the above circuit is 5 ohms, and the other parameters are same as those of an ideal diode. Then what is the d.c. component of the source current ?

(a) $\dfrac{V_m}{50\pi}$

(b) $\dfrac{V_m}{50\pi\sqrt{2}}$

(c) $\dfrac{V_m}{100\pi\sqrt{2}}$

(d) $\dfrac{2V_m}{50\pi}$

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

List I (Instruction code)	List II (Addressing mode)
A. JUMP 2021 H	1. Direct addressing
B. LDAX B	2. Immediate addressing
C. IN 10H	3. Indirect Register addressing
D. RLC	4. Implicit addressing

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

46. Two MOSFETS M_1 and M_2 are connected in parallel to carry a total current of 20 A. The drain to source voltage of M_1 is 2·5 V and that of M_2 is 3 V. What are the drain currents of M_1 and M_2 when the current sharing series resistances are each of 0·5 Ω ?

(a) 10·5 A and 9·5 A

(b) 9·5 A and 10·5 A

(c) 10·5 A and 10·5 A

(d) 9·5 A and 9·5 A

47. If an FM wave is represented by the equation $e = 10 \sin (9 \times 10^8 t + 4 \sin 1500\, t)$, then what is the carrier frequency ?

(a) 127·32 MHz

(b) 150·00 MHz

(c) 143·31 MHz

(d) 208·00 MHz

48. In a single phase VSI bridge inverter, the load current is $I_o = 200 \sin(\omega t - 45°)$ mA. The d.c. supply voltage is 220 V. What is the power drawn from the supply ?

(a) 9·8 W

(b) 19·8 W

(c) 27·25 W

(d) 34·03 W

49. Which one of the following is a disadvantage of digital transmission as compared to analog transmission ?

(a) Digital signals cannot be multiplexed efficiently

(b) Digital transmission is less immune to channel noise

(c) Digital signals needs to be coded before transmission

(d) Digital transmission needs more bandwidth

50. What are the number of memories required of size 16×4 to design a memory of size 64×8 ?

(a) 2

(b) 4

(c) 6

(d) 8

51.
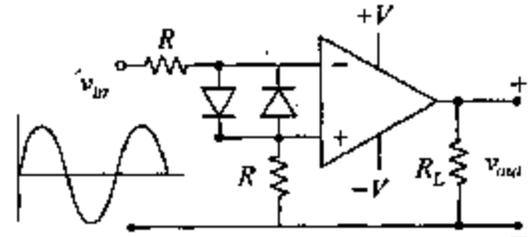
For the above circuit what will be the output for the sinusoidal input shown at the input terminal ?

(a)
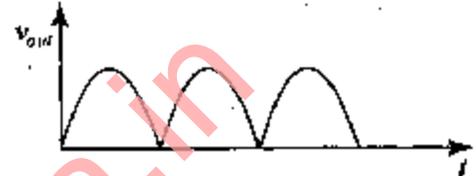
(b)
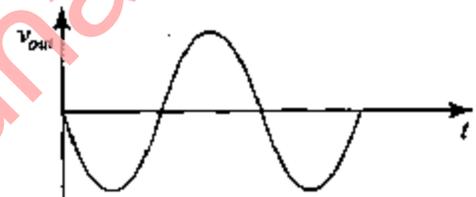
(c)
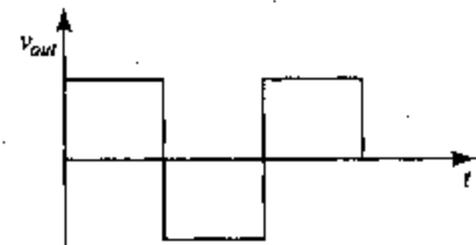
(d)
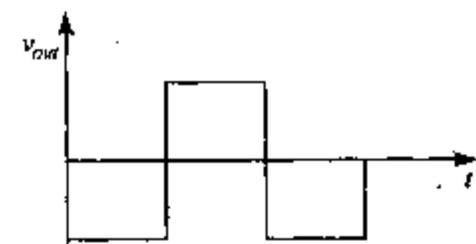
52. A salient pole synchronous generator delivering power to an infinite bus through a reactive tie line reaches its steady state stability limit. What is the power angle of the generator relative to the infinite bus voltage reference ?

(a) Greater than 90 degrees

(b) Equal to 90 degrees

(c) Less than 90 degrees

(d) Zero

53. The starting current of an induction motor is 5 times the full-load current while the full-load slip is 4%. What is the ratio of starting torque to full-load torque ?

(a) 0·6

(b) 0·8

(c) 1·0

(d) 1·2

54. Consider the following statements :

EMF induced per phase in an alternator depends on

1. Frequency
2. Number of turns per phase
3. Pitch factor
4. Distribution factor

Which of the above statements is/are correct ?

(a) 1 only

(b) 1, 2, 3 and 4

(c) 2 and 3 only

(d) 3 and 4 only

55. Consider the following statements regarding the pumped storage plants :

1. A pumped storage plant is a peak load plant.
2. The starting time of a pumped storage plant is very long.
3. Reversible turbines and pumps are very suitable for pumped storage plants.
4. Pumped storage plants can be used for load frequency control.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2 only

(c) 1, 3 and 4

(d) 3 and 4 only

56.

230 V / 50-0-50 V
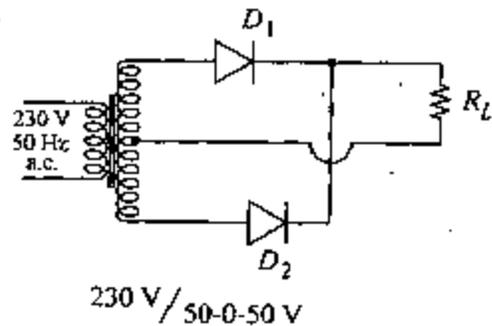
The input voltage for the given full-wave rectifier circuit is 230 V a.c. then what is the peak inverse voltage across diodes D_1 and D_2 ?

(a) $100\sqrt{2}$ Volts

(b) 100 Volts

(c) $50\sqrt{2}$ Volts

(d) 50 Volts

57. Which one of the following addressing technique is *not* used in 8085 microprocessor ?

(a) Register

(b) Immediate

(c) Register indirect

(d) Relative

58. An AM modulator has output
$S(t) = 20\cos(300\,\pi t) + 6\cos(320\,\pi t) + 6\cos(280\,\pi t)$.

Then what is the modulation index of the wave ?

(a) More than 100%

(b) 0·93

(c) 0·3

(d) 0·6

59.
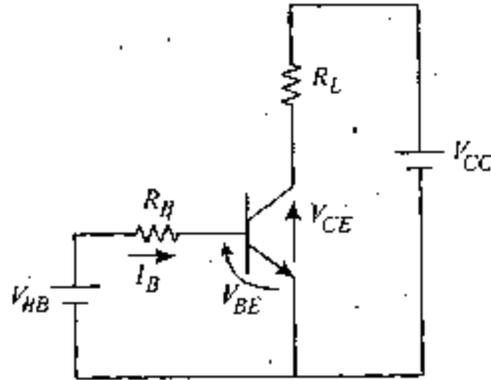
β of a BJT varies from 15 to 65. $R_L = 10\ \Omega$, $V_{CC} = 120$ V and $V_{BB} = 8$ V. If $V_{CE(Sat)} = 1.5$ V and $V_{BE(Sat)} = 1.75$ V then what is the value of R_B that will result in saturation with an overdrive factor of 10 ?

(a) $7.9\ \Omega$

(b) $0.79\ \Omega$

(c) $79\ \Omega$

(d) $7.9\ k\Omega$

60. What is the effect of blanking time on output voltage in PWM inverter ?

(a) Distortion in instantaneous voltage at current zero crossing

(b) Low order space harmonics in output voltage

(c) Distribution in instantaneous voltage at voltage zero crossing

(d) High order time harmonics in output voltage

61. Consider the following statements :

The thermal noise power generated by a resistor is proportional to

1. The value of the resistor.

2. The absolute temperature.

3. The bandwidth over which it is measured.

4. The Boltzmann's constant.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 2 only

(c) 2 and 3 only

(d) 2, 3 and 4

62. Consider the following statements :

1. The output unit of a computer communicate the response of the computer to the user.

2. Read/write memory is volatile.

3. The flip-flops in a register are connected in parallel.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2

(c) 2 and 3

(d) 3 only

63.
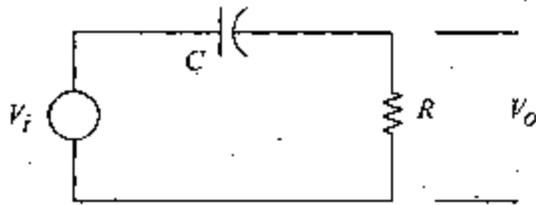
In the above shown circuit, under what conditions the output V_o will be proportional to $\frac{dv_i}{dt}$ (with T = time period of input)

(a) $RC = T$

(b) $RC \gg T$

(c) $RC \ll T$

(d) Both R and C large

64. Transient stability of a 3-phase power systems having more than one synchronous generator is not affected by which one of the following specifications ?

(a) Initial operating conditions of generators

(b) Quantum of large power disturbance

(c) Fast fault clearance and redo sure

(d) Small changes in system frequency

65. Consider the following :

1. L.P.F. method

2. E.M.F. method

3. Z.P.F. method

4. M.M.F. method

Which of the above methods are correct for determination of voltage regulation of an alternator ?

(a) 1, 2 and 3

(b) 2, 3 and 4

(c) 2 and 3 only

(d) 3 and 4 only

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

List I (Machine Components)	List II (Type of Machine)
A. Amortisseur winding	1. Squirrel cage induction motor
B. Breather	2. D.C. motor
C. End-Rings	3. Transformer
D. Commutator	4. Synchronous motor

Code :

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

67. The maximum demand of a consumer is 2 kW and the corresponding daily energy consumption is 30 units. What is the corresponding load factor ?

(a) 25%

(b) 50%

(c) 62·5%

(d) 75%

68.
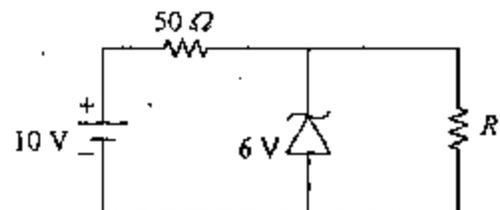
The 6 V zener diode as shown in the circuit above, has zero zener resistance and a knee current of 5 mA. Then what is the minimum value of R so that the voltage across it does not fall below 6 V ?

(a) 1200 ohms

(b) 80 ohms

(c) 50 ohms

(d) 40 ohms

69. When the operand requires for an instruction is stored inside the processor, then what this addressing mode is called ?

(a) Direct

(b) Register

(c) Implicit

(d) Immediate

70. How much power will an AM transmitter, rated at 50 kW, radiate if it is modulated to 100% ?

(a) 25 kW

(b) 50 kW

(c) 75 kW

(d) 100 kW

71. For an SCR, the gate cathode characteristic has a straight line slope of 140. For trigger source voltage of 20 V and allowable gate power dissipation of 0·5 Watts, what is the gate source resistance ?

(a) 200 Ω

(b) 255 Ω

(c) 195 Ω

(d) 185 Ω

72. An AC capacitor is to be switched in parallel with AC line using back to back connected thyristor. What is the firing angle of thyristor for first switching ?

(a) 0°

(b) 180°

(c) 90°

(d) 45°

73. A communication channel is to receive signal power S and the noise at the receiver input is additive thermal noise, with uniform power spectral density (psd). It is found that if the bandwidth is 1 MHz, the channel capacity is 10 Mbps. What would be the channel capacity for the same signal power and same noise psd, if the bandwidth is unlimited (tends to be infinite) ?

(a) Zero

(b) Infinite

(c) 15 Mbps

(d) 15 Gbps

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

List I (Microprocessor pin)	List II (Signals on pin)
A. TRAP	1. Interrupt
B. HLDA	2. Initializing
C. RESET	3. Enable
D. ALE	4. Memory access

Code :

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

75. Consider the following statements :

1. Only even harmonics are present in the output.

2. Provides more output per device for a given amount of distortion.

3. Core saturation of transformer is avoided.

4. Power supply hum is absent in the output.

Which of the above statements is/are correct for a push-pull amplifier ?

(a) 1 only

(b) 1 and 2 only

(c) 1, 2 and 3

(d) 2, 3 and 4

76.
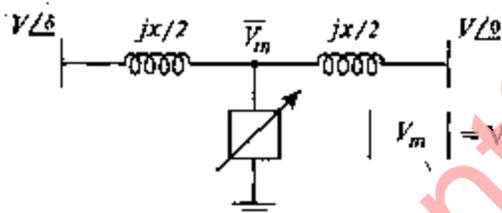
In a transmission line, the mid-point voltage is maintained to V by a compensating device as shown in the circuit above. What is the real power flow through the line ?

(a) $\dfrac{V^2}{X}\sin\dfrac{\delta}{2}$

(b) $\dfrac{2V^2}{X}\sin\delta$

(c) $\dfrac{V^2}{X}\sin\delta$

(d) $\dfrac{2V^2}{X}\sin\dfrac{\delta}{2}$

77. What is the rotor copper loss of a 3 phase 550 Volt, 50 Hz, 6 poles induction motor developing 4·1 kW at the shaft with mechanical loss of 750 W at 970 rpm ?

(a) 175 W

(b) 150 W

(c) 100 W

(d) 250 W

78. In what form the initial energy will be released for the 200 MeV per fission by a neutron in a slow thermal nuclear reactor ?

(a) Heat energy

(b) Electromagnetic radiation

(c) Kinetic energy of particles and electromagnetic radiation

(d) Kinetic and sound energy

79. In a certain self biased Si npn transistor the d.c. base voltage is 3·2 V then what is the d.c. emitter voltage ? (Assume the transistor is in linear-active mode)

(a) 0·7 V

(b) 2·5 V

(c) 3·2 V

(d) 3·9 V

15

A – O-FTF-J-FFB

80. What is the correct 8085 assembly language instruction that stores the contents of H and L registers into the memory locations 1080 H and 1081 H respectively ?

(a) SPHL 1080 H

(b) SHLD 1080 H

(c) STAX 1080 H

(d) SPHL 1081 H

81. For which one of the following modulated signals, the original message, up to a scaling factor can be recovered using envelope detection ?

(a) $20 \cos(200 \pi t) + 30 m(t)\cos(200 \pi t)$

(b) $20 \cos(200 \pi t) + 16 m(t)\cos(200 \pi t)$

(c) $10 m(t)\cos(400 \pi t)$

(d) $10 \cos m(t)\cos(400 \pi t)$

82. An SCR is rated for 650 V PIV. What is the voltage for which the device can be operated if the voltage safety factor is 2 ?

(a) 325 V rms

(b) 230 V rms

(c) 459 V rms

(d) 650 V rms

83. A-6-pulse SCR converter is connected to a 230 V, 3-phase, 50 Hz, ac mains and is controlling a dc drive with terminal voltage 205 volt and rated current of 105 Amp. The commutation angle $\mu = 18°$ and firing angle $\alpha = 45°$, what is the rating of shunt compensator and power factor ?

(a) 21·6 kVAR, 0·707

(b) 22·68 kVAR, 0·69

(c) 21·6 kVAR, 0·69

(d) 22·68 kVAR, 0·707

84. Which one of the following statements is correct ?

The threshold effect in demodulators is

(a) Exhibited by all receivers when the input SNR is low

(b) Exhibited only by correlation receivers

(c) The rapid fall in the output SNR when input SNR falls below a particular value

(d) The exponential rise in the output SNR when input SNR is increased above a particular value

85. The stack pointer of an 8085 microprocessor is ABCDH. At the end of execution of the sequence of instructions, what will be the content of the stack pointer ?

    PUSH PSW
    XTHL
    PUSH D
    JMP   FC70H

(a) ABCBH

(b) ABCAH

(c) ABC9H

(d) ABC8H

86. What is the main source of distortion in a push-pull amplifier ?

(a) Fundamental component

(b) Second harmonic

(c) Third harmonic

(d) All even harmonics

87. Which one of the following is reduced by using stock bridge dampers on power overhead transmission lines ?

(a) Sag

(b) Conductor vibration

(c) Line losses

(d) Mechanical tension

88. A single phase full converter feeds power to RLE load with $R = 10\,\Omega$, $L = 10$ mH and $E = 50$ V, the ac source voltage is 230 V, 50 Hz. For continuous conduction, what is the average value of load current for firing angle delay of $60°$?

(a) 4·63 A

(b) 6 A

(c) 6·5 A

(d) 5·35 A

89. An 8085 microprocessor is executing the programme as follows :

        MVI A, 20 H
        MVI B, 10 H
BACK : NOP
        ADD B
        RLC
        JNC BACK
        HLT

How many times the instruction NOP will be executed ?

(a) 4

(b) 3

(c) 2

(d) 1

90.
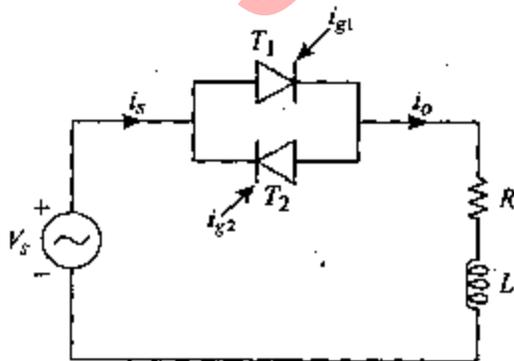
Fig-1
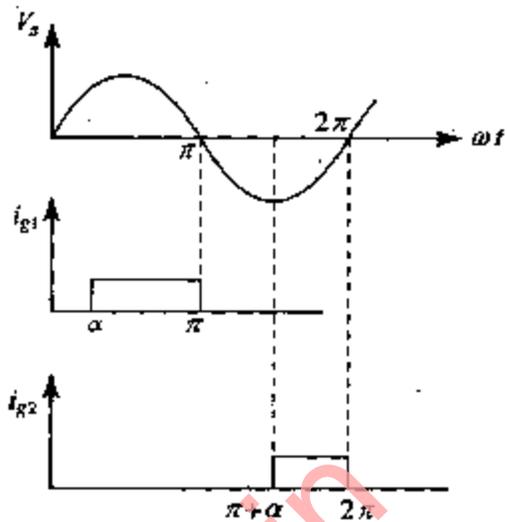
Fig-2

In the ac regulator of Fig-1, the supply voltage and gate currents waveforms are as in Fig-2, what is the load voltage waveform for $R = 0$?

(a)

(b)

(c)

(d)
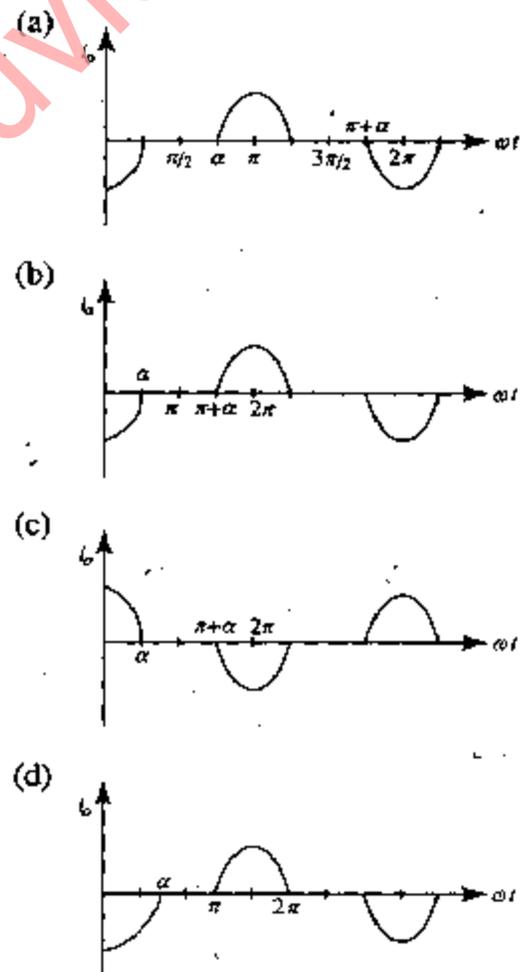
91. An amplifier without feedback, when fed with a 1 V, 50 Hz input signal gives an output of 30 V, 50 Hz with a 5% 2nd order distortion. When 10% of the output is fedback what is the 2nd order distortion ?

(a) 0·375 V

(b) 1·3 V

(c) 0·75 V

(d) 3 V

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

List I	List II
A. Magnetic flux density	1. Siemens
B. Shunt admittance	2. Tesla
C. Attenuation co-efficient	3. Radian
D. Phase-change co-efficient	4. Neper

Code :

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

93. What is the effect of the field failure of salient pole synchronous motor connected with infinite bus ?

(a) Reduce motor torque and speed

(b) Not charge motor torque and speed

(c) Stop the motor

(d) Reduce motor torque but motor will continue to run at synchronous speed

94. A DC chopper is used in regenerative braking mode of a dc series motor. The dc supply is 600 V, the duty cycle is 70%. The average value of armature current is 100 A. It is continuous and ripple free. What is the value of power fedback to the supply ?

(a) 3 kW

(b) 9 kW

(c) 18 kW

(d) 35 kW

95. What is the ratio of starting torque and maximum torque of a 3 phase, 50 Hz, 4 pole induction motor for a maximum torque at 1200 rpm ?

(a) 0·421

(b) 0·384

(c) 0·6

(d) 0·5

96. When a transistor is used in switching mode then what is the turn-on time ?

(a) Sum of delay time and rise time

(b) Sum of rise time and storage time

(c) Sum of delay time and storage time

(d) Sum of rise time and fall time

97. For which one of the following, the instruction XRA A in 8085 microprocessor can be used ?

(a) Set the carry flag

(b) Set the zero flag

(c) Reset the carry flag and clear the accumulator

(d) Transfer FFH to the accumulator

98. If a full wave fully controlled converter is modified as a full wave half controlled converter, what will be the maximum value of active power (P) and the maximum value of reactive power demand (Q)?

	P	Q
(a)	Double	Half
(b)	Unchanged	Unchanged
(c)	Half	Double
(d)	Unchanged	Half

99. The power input to a 415 V, 50 Hz, 6 pole 3-phase induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and friction and windage losses total 2 kW. What is the efficiency of motor?

(a) 92·5%

(b) 92%

(c) 90%

(d) 88%

100. A short transmission line having zero resistance and total series reactance of 0·4 pu is provided with reactive power compensation at the mid-point of the line such that the mid-point voltage is held at 0·96 pu when the voltage at both ends are 1·0 pu. What is the steady state power transmission limit of such a system?

(a) 4·8 pu

(b) 0·0 pu

(c) 2·4 pu

(d) 9·6 pu

101. In single pulse modulation of PWM inverters, the pulse width is 120°. For an input voltage of 220 V dc, what is the rms value at the fundamental component of the output voltage?

(a) 171·5 V

(b) 254·0 V

(c) 127·0 V

(d) 89·81 V

102.
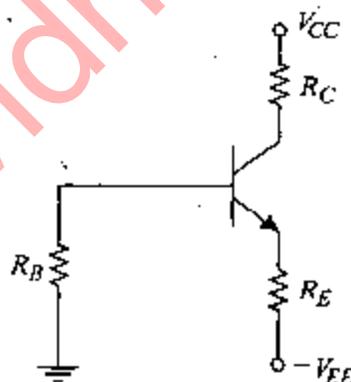
The Si transistor as shown in the circuit above has $\beta = 50$ and negligible leakage current. If $V_{CC} = 18$ V, $V_{EE} = 4$ V, $R_E = 200\ \Omega$, $R_C = 4\ k\Omega$, $R_B = 72\ k\Omega$, what is the value of the quiescent collector current I_{CQ}?

(a) 1·1 mA

(b) 2 mA

(c) 5 mA

(d) 3·6 mA

103. An output device is interfaced with an 8085 microprocessor as memory-mapped I/O. The address of the device is 1000 H. In order to output data from the accumulator to the device, what will be the sequence of instructions ?

(a) LXI H, 1000H
MOV A, M

(b) LXI H, 1000H
MOV M, A

(c) LHLD 1000H
MOV A, M

(d) LHLD 1000H
MOV M, A

104. What is the form of the Y_{bus} matrix for carrying out load flow studies by Gauss-Seidal method of a power system having mesh connection of nodes ?

(a) Symmetric but not diagonal matrix

(b) Diagonal matrix

(c) Antisymmetric matrix

(d) Sparse asymmetric matrix

105.
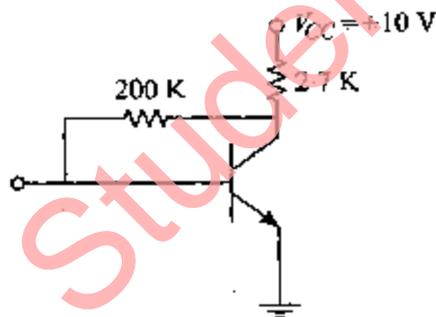
In the above circuit as shown $\beta = 99$, $V_{BE} = 0.6$ V, then what are the values of V_C and I_C corresponding to the operating point ?

(a) 4·6 V and 1·98 mA

(b) 4·7 V and 2·00 mA

(c) 5·4 V and 1·56 mA

(d) 4·2 V and 2·1 mA

106. Two fully controlled three-phase bridges are connected in anti parallel across a load to provide reversible DC voltage to the load. The bridges operate in circulating current mode. The input is 3-phase 440 volt, 50 Hz AC supply, and the maximum load current is 30 Amp. The peak value of the circulating current is taken to be 6 A. What is the value of inductance for limiting circulating current ?

(a) 30 mH

(b) 32 mH

(c) 36 mH

(d) 38 mH

107.
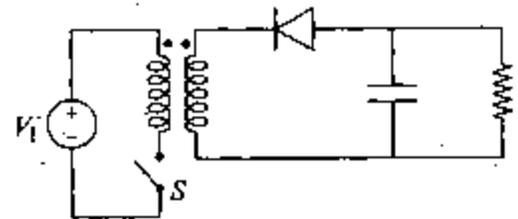
For the isolated buck boost converter as shown in the circuit above, the output voltage is to be 35 V at a duty cycle of 30%. The DC input is obtained from a front end rectifier without voltage doubling fed from a 115 V AC. What is the peak forward blocking voltage of the switching element ?

(a) 232·3 V

(b) 69·69 V

(c) 162·61 V

(d) 542 V

20

108. If the amplification of a single stage is not sufficient or the input or output impedance is not of the correct magnitude for the intended application how may two stages be connected to achieve desired result ?

   (a) Cascode connection

   (b) Complementary symmetry connection

   (c) Cascade connection

   (d) Totem pole connection

Directions :

Each of the next Twelve (12) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

   (a) Both A and R are individually true and R is the correct explanation of A

   (b) Both A and R are individually true but R is *not* the correct explanation of A

   (c) A is true but R is false

   (d) A is false but R is true

109. Assertion (A) : The rotor speed of induction motor is less than the synchronous speed of rotating magnetic field.

   Reason   (R) : At synchronous speed motor torque is zero.

110. Assertion (A) : Rotor core loss at rated speed of induction motor is negligibly small.

   Reason   (R) : Induced emf frequency of the rotor circuit at rated speed is very low, because slip of the motor at rated speed is low.

111. Assertion (A) : A capacitor is connected in the polarizing circuit of the mho relay to prevent its in operation when three phase faults occur very close to the relay.

   Reason   (R) : Capacitor provides memory action and thus maintains polarizing flux for several cycles following the fault.

112. Assertion (A) : In small-signal R-C coupled amplifiers the gain falls in the high frequency range.

   Reason   (R) : The decline in gain with frequency is due to the reactance of the coupling capacitor.

113. Assertion (A) : In a typical RC coupled amplifier, the gain falls at high frequencies.

   Reason   (R) : The amplifier has to use coupling capacitors in the input and output side for isolating dc biasing circuit and ac signal.

114. Assertion (A) : The DAC (Digital Analog Converter) cannot be interfaced to microprocessor in an interrupt driven mode.

Reason (R) : DAC neither needs a start convert pulse nor it has indication of conversion.

115. Assertion (A) : Monostable multivibrators (IC 74121) are used in a microprocessor based system for frequency measurement.

Reason (R) : Microprocessor counts the number of interrupt signals/second or within a specified interval through ISR.

116. Assertion (A) : Equalizers are used in receivers to increase the SNR of the demodulator.

Reason (R) : The equalizer is designed such that, their transfer function is inversely related to that of the channel.

117. Assertion (A) : FM is capable of exchanging SNR for the transmission bandwidth while in AM systems this feature is not available.

Reason (R) : Transmission bandwidth in FM systems is much higher than in AM systems.

118. Assertion (A) : DSB modulation scheme is superior to SSB modulation scheme as far as noise performance is concerned.

Reason (R) : DSB modulation requires twice the bandwidth as compared to SSB modulation.

119. Assertion (A) : FSK signalling is inferior to PSK signalling.

Reason (R) : PSK requires less bandwidth than FSK.

120. Assertion (A) : QPSK modulation allows higher data rate than BPSK for the same bandwidth occupying.

Reason (R) : Gray code is used for the 4 signals transmitted in QPSK.

IES 2009 Solutions
Electrical Engineering (Paper-I)

Q. No.	A	B	C	D	Q. No.	A	B	C	D	Q. No.	A	B	C	D	Q. No.	A	B	C	D
1.	c	b	c	a	31.	b	c	a	c	61.	c	a	c	b	91.	a	c	b	c
2.	b	c	a	c	32.	c	a	c	b	62.	a	c	b	c	92.	c	b	c	a
3.	a	d	a	b	33.	d	a	b	a	63.	a	b	a	d	93.	b	a	d	b
4.	b	a	a	d	34.	a	a	d	b	64.	a	d	b	c	94.	d	b	a	a
5.	b	a	c	a	35.	a	c	a	b	65.	c	a	b	a	95.	a	b	a	c
6.	b	c	c	c	36.	c	c	c	b	66.	c	c	b	c	96.	c	b	c	c
7.	a	a	b	d	37.	a	b	d	a	67.	b	d	a	b	97.	d	a	a	b
8.	a	b	d	b	38.	b	d	b	a	68.	d	b	a	b	98.	b	a	b	d
9.	c	c	c	d	39.	c	c	d	c	69.	c	d	c	c	99.	d	c	c	c
10.	b	c	a	d	40.	c	a	d	b	70.	a	d	b	c	100.	d	b	c	a
11.	d	d	a	c	41.	d	a	c	d	71.	a	c	d	d	101.	c	d	d	b
12.	a	b	a	c	42.	b	a	c	c	72.	a	c	a	b	102.	c	a	b	a
13.	a	a	c	c	43.	a	c	c	c	73.	c	c	a	a	103.	c	a	a	c
14.	d	c	a	d	44.	c	a	c	c	74.	a	d	d	c	104.	d	d	c	a
15.	b	d	a	d	45.	d	a	d	c	75.	a	d	b	d	105.	d	b	d	a
16.	b	c	b	d	46.	c	b	d	b	76.	b	d	b	c	106.	d	b	c	b
17.	c	b	d	b	47.	b	d	c	c	77.	d	b	c	b	107.	b	c	b	d
18.	c	d	c	b	48.	d	c	b	c	78.	c	b	c	d	108.	b	c	d	c
19.	d	a	d	a	49.	a	d	a	d	79.	d	a	d	a	109.	a	d	a	d
20.	b	c	d	b	50.	c	d	b	b	80.	d	b	b	c	110.	b	b	c	d
21.	a	c	c	d	51.	c	c	d	a	81.	c	d	a	c	111.	d	a	c	c
22.	b	a	b	d	52.	c	b	d	b	82.	b	d	b	c	112.	d	b	c	b
23.	d	c	c	b	53.	c	c	b	c	83.	c	b	d	c	113.	b	d	c	c
24.	b	a	d	b	54.	a	d	c	b	84.	d	c	b	a	114.	c	b	a	c
25.	d	a	c	a	55.	a	c	c	d	85.	c	a	d	a	115.	a	d	a	c
26.	c	a	a	a	56.	a	a	a	c	86.	a	a	c	a	116.	a	c	a	c
27.	a	a	a	c	57.	a	a	c	a	87.	a	c	a	a	117.	c	a	a	a
28.	b	c	b	d	58.	c	b	d	b	88.	b	d	b	c	118.	d	b	c	b
29.	c	a	c	c	59.	c	c	a	c	89.	d	a	d	a	119.	c	c	a	c
30.	c	c	c	b	60.	c	c	b	b	90.	c	b	c	c	120.	b	c	c	c

IES 2009 Solutions
Electrical Engineering (Paper-II)

Q. No.	A	B	C	D
1.	c	c	d	a
2.	b	c	b	d
3.	b	b	c	d
4.	c	a	d	c
5.	b	b	b	b
6.	—	a	b	a
7.	b	c	c	b
8.	a	d	b	b
9.	a	b	c	c
10.	b	a	c	c
11.	d	a	c	a
12.	d	c	c	b
13.	a	d	b	b
14.	d	a	c	a
15.	c	b	d	a
16.	d	a	c	—
17.	b	c	b	a
18.	c	b	c	c
19.	b	d	b	a
20.	b	d	a	a
21.	b	d	b	a
22.	b	c	b	a
23.	c	c	—	b
24.	d	b	c	a
25.	d	c	c	b
26.	b	a	c	d
27.	a	d	b	a
28.	d	d	d	a
29.	c	b	b	b
30.	a	d	a	a

Q. No.	A	B	C	D
31.	c	d	a	c
32.	c	b	d	b
33.	b	c	d	b
34.	a	d	c	c
35.	b	b	b	b
36.	a	b	a	—
37.	c	c	b	b
38.	d	b	b	a
39.	b	c	c	a
40.	a	c	c	b
41.	a	c	a	b
42.	c	c	b	a
43.	d	b	b	a
44.	a	c	a	a
45.	b	d	a	c
46.	a	c	—	d
47.	c	b	a	b
48.	b	c	c	c
49.	d	b	a	b
50.	d	a	a	b
51.	d	b	a	b
52.	c	b	a	b
53.	c	—	b	a
54.	b	c	a	d
55.	c	c	b	d
56.	a	c	d	b
57.	d	b	a	a
58.	d	d	a	a
59.	—	—	—	—
60.	d	a	a	a

Q. No.	A	B	C	D
61.	d	a	c	c
62.	b	d	b	c
63.	c	d	b	c
64.	d	c	c	c
65.	b	b	b	b
66.	b	—	—	x
67.	c	b	c	c
68.	b	a	a	d
69.	c	c	a	b
70.	c	c	b	a
71.	c	a	d	a
72.	c	b	d	c
73.	b	b	a	d
74.	c	a	d	a
75.	d	a	c	b
76.	c	—	d	a
77.	b	a	b	c
78.	c	c	c	b
79.	b	a	b	d
80.	a	a	b	d
81.	b	a	b	d
82.	b	a	b	c
83.	—	b	c	c
84.	c	a	d	b
85.	c	b	d	c
86.	c	d	b	a
87.	b	b	a	d
88.	a	a	a	—
89.	—	—	—	—
90.	a	a	a	d

Q. No.	A	B	C	D
91.	a	c	c	d
92.	d	b	c	b
93.	d	b	b	c
94.	c	c	a	d
95.	b	b	b	b
96.	a	—	a	b
97.	b	b	c	c
98.	b	a	d	b
99.	c	a	b	c
100.	c	b	a	c
101.	a	d	a	c
102.	b	d	c	c
103.	b	a	d	b
104.	a	d	a	c
105.	a	c	b	d
106.	—	d	a	c
107.	a	b	c	b
108.	c	b	c	c
109.	a	b	d	b
110.	a	b	d	a
111.	a	b	d	b
112.	a	b	c	b
113.	b	c	c	—
114.	a	d	b	c
115.	b	d	c	c
116.	d	b	a	c
117.	a	a	d	b
118.	a	d	d	d
119.	b	c	b	b
120.	a	a	d	d