Booklet Series

A

AEUD

Booklet No.

790589

QUESTION BOOKLET

ELECTRICAL ENGINEERING

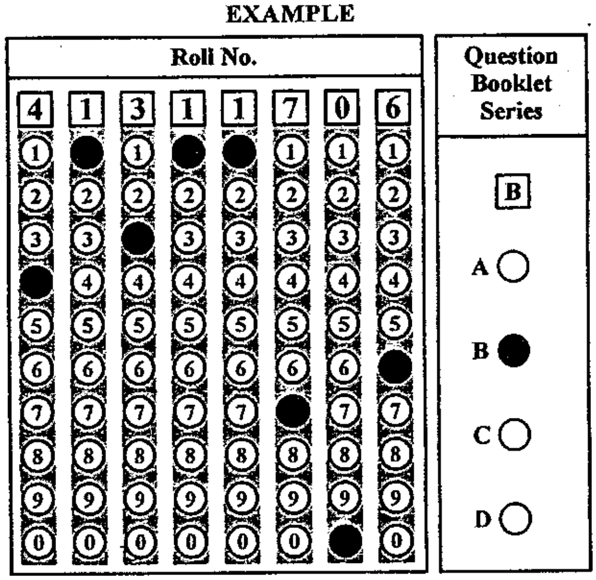
PAPER - I (06)

Time Allowed : 2 Hours **Maximum Marks : 200**

INSTRUCTIONS FOR CANDIDATES

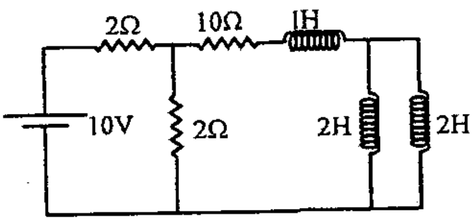
1. Please do not open this Question Booklet until you are told to do so.
2. Candidate must fill up the necessary informations in the space provided on the OMR answer sheet before commencement of the examination.
3. Answer sheet will be processed by electronic device. Invalidation of answer sheet due to incomplete / incorrect filling of relevant circle of Roll No. and Question Booklet Series in the OMR answer sheet shall result in cancellation of candidature. Any deficiency in filling up OMR answer sheet will be the sole responsibility of the candidate.
4. An example is given below how to fill / mark (darken) Roll No. 41311706 and Question Booklet Series - B. Accordingly, you have to fill / mark (darken) the Roll No. and Question Booklet Series given to you in your OMR answer sheet.

EXAMPLE



5. For marking the correct answer, darken one circle by **BLUE BALLPOINT PEN** only.
6. Please do not mark (darken) more than one circle. Darkening more than one circle against an answer will be treated as wrong answer.
7. Do not detach any leaf from this Question Booklet. After the examination, hand over the OMR answer sheet to the Room Invigilator. You are allowed to take the Question Booklet and carbon copy of the OMR answer sheet after examination is over.
8. Each question carries 2 marks. There is no negative marking for any wrong answer.
9. Possession and use of Calculator, Mobile Phone, Pager or any other electronic gadget is strictly prohibited in the Examination Hall.
10. Please abide by the instructions above and those given on the OMR answer sheet, failure to comply these instructions will be sole responsibility of the candidates.

1. The time constant of the circuit shown below is



(A) 2/11 sec

(B) 2 sec

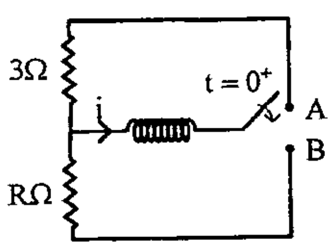
(C) 11 sec

(D) 3/11 sec

2. In the circuit shown in figure the switch is moved from position A to position B at time t = 0 sec. The current i through the inductor satisfies the following conditions :

$$i(0) = -8A, \left.\frac{di}{dt}\right|_{t=0} = 3A/sec, i(\infty) = 4A$$

The value of R is



(A) 0.5 Ω

(B) 2 Ω

(C) 4 Ω

(D) 12 Ω

3. A series R-L-C circuit is switched on with a step voltage V at t = 0 sec. What are the initial and final values of current in the circuit ?

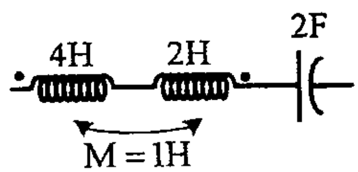
(A) $\frac{V}{R}, \frac{V}{R}$

(B) 0, ∞

(C) 0, 0

(D) $0, \frac{V}{R}$

4. The resonant frequency of the given circuit is



(A) $\frac{1}{2\pi\sqrt{3}}$Hz

(B) $\frac{1}{4\pi\sqrt{3}}$Hz

(C) $\frac{1}{4\pi\sqrt{2}}$Hz

(D) $\frac{1}{2\pi\sqrt{2}}$Hz

5. If the Q factor of a coil at resonant frequency of 2.4 MHz is 120 for series resonant circuit. The corresponding bandwidth is

(A) 225 kHz

(B) 100 kHz

(C) 20 kHz

(D) 48 MHz

6. An RMS voltage of 35 V is applied across a $1-\phi$ RC series circuit. If the RMS voltage across the capacitor is 28V, then the angle between current and supply voltage is

(A) $\sin^{-1}(0.6)$

(B) $\cos^{-1}(0.8)$

(C) $\tan^{-1}(0.75)$

(D) $\cot^{-1}(0.75)$

7. Causer and Foster forms of realizations are used only for

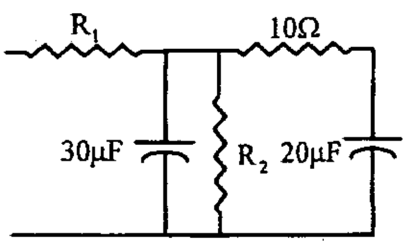
(A) Driving point reaction functions

(B) Transfer reactance functions

(C) Driving point impedance functions

(D) Transfer impedance functions

8. For the network shown in fig. $Z(0) = 5\ \Omega$ and $Z(\infty) = 2\ \Omega$, what are the values of R_1 and R_2 respectively ?



(A) $2\ \Omega, 3\ \Omega$

(B) $2\ \Omega, 1\ \Omega$

(C) $3\ \Omega, 2\ \Omega$

(D) None of the above

9. The poles and zeros of a driving point impedance function are simple and interlace on the negative real axis with a pole closest to the origin it can be realized

(A) As LC driving point impedance

(B) As RL driving point impedance

(C) As RC driving point impedance

(D) As R_L_C driving point impedance

10. A two port network is defined by following pair of equations $i_1 = 2V_1 + V_2$ and $i_2 = V_1 + V_2$. Its impedance parameters $\begin{pmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{pmatrix}$ are

(A) $\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$

(B) $\begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix}$

(D) $\begin{pmatrix} 2 & -1 \\ -1 & 1 \end{pmatrix}$

11. The h parameters h_{11} and h_{22} are related to Z and Y parameters as

(A) $h_{11} = Z_{11}$ and $h_{22} = \frac{1}{Z_{22}}$

(B) $h_{11} = Z_{11}$ and $h_{22} = Y_{22}$

(C) $h_{11} = \frac{1}{Y_{22}}$ and $h_{22} = \frac{1}{Z_{22}}$

(D) $h_{11} = \frac{1}{Y_{11}}$ and $h_{22} = Y_{22}$

12. A, B, C, D represent the transmission parameters of 2-port network. State the condition for reciprocal network.

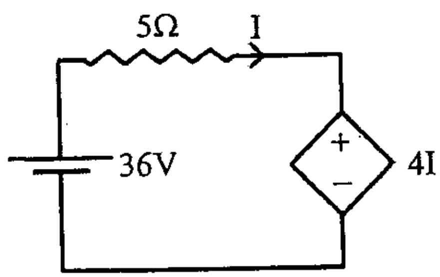
(A) $AB - CD = 1$

(B) $AD - BC = 1$

(C) $AB - CD = 0$

(D) $AD - BC = 0$

13. The current in the given circuit is



(A) 9A

(B) 7.75 A

(C) 10.25 A

(D) 4 A

14. The maximum space rate of change of the function which is increasing in the direction of the function is known as

(A) Curl of the vector function

(B) Gradient of the scalar function

(C) Divergence of the vector function

(D) Stokes theorem

15. The vector from the origin to the point A is given as (6, –2, –4) and the unit vector from the origin towards point B is (2/3, –2/3, 1/3). If points A and B are ten units apart, the coordinates of point B are

(A) $6.2a_x - 6.2a_y + 3.1a_z$

(B) $7.75a_x - 7.758a_y + 3.876a_z$

(C) $6.2a_x - 7.83a_y + 3.1a_z$

(D) $7.83a_x - 6.2a_y + 3.92a_z$

16. Find the interior angles at A and B of the triangle defined by three points A (1, 3, –2), B (–2, 4, 5) and C (0, –2, 1).

(A) $\theta_A = 62.5°, \theta_B = 45°$

(B) $\theta_A = 65.3°, \theta_B = 30°$

(C) $\theta_A = 65.3°, \theta_B = 45.9°$

(D) $\theta_A = 60°, \theta_B = 45°$

17. The electric field across a dielectric air interface is shown in the given figure. The surface charge density on the interface is $\dfrac{\epsilon=1 \uparrow \bar{E}=\bar{a}_x}{\epsilon=2 \uparrow \bar{E}=2\bar{a}_x}$

(A) $-4\,\epsilon_0$

(B) $-3\,\epsilon_0$

(C) $-2\,\epsilon_0$

(D) $-\epsilon_0$

18. Ohm's law in point form in field theory can be expressed as

(A) $V = RI$

(B) $J = \frac{\overline{E}}{\sigma}$

(C) $J = \sigma\overline{E}$

(D) $R = \frac{\rho l}{A}$

19. A plane slab of dielectric having dielectric constant 5, placed normal to a uniform field with a flux density of $2C/m^2$ is uniformly polarized. The polarization of the slab is

(A) $0.4\ C/m^2$

(B) $1.6\ C/m^2$

(C) $2.0\ C/m^2$

(D) $6.4\ C/m^2$

20. The electric field intensity is defined as

(A) Force per unit charge

(B) Force on the test charge

(C) Force per unit charge on a test charge

(D) Product of force and charge

21. Gauss surface is

(A) Real boundary

(B) Imaginary surface

(C) Radial surface

(D) Tangential surface

22. Six equal point charges Q = 10 nC are located at 2 m, 3 m, 4 m, 5 m, 6 m, 7 m. Find the potential at origin.

(A) 140.35

(B) 141.35

(C) 142.35

(D) 143.35

23. Through method of images a problem is solved by replacing the boundary with a polygon of shape :

(A) Rectangle

(B) Trapezoid

(C) Square

(D) Triangle

24. Stokes' theorem can be used to find the following :

(A) Area enclosed by a function in the given region

(B) Volume enclosed by a function in the given region.

(C) Linear distance

(D) Curl of the function

25. Calculate the EMF when the flux is given by 3 sin (t) + 5 cos (t).

(A) 3 cos (t) – 5 sin (t)

(B) –3 cos (t) + 5 sin (t)

(C) –3 sin (t) + 5 cos (t)

(D) 3 sin (t) + 5 cos (t)

26. When the conduction current density and displacement current density are same, then the dissipation factor will be

(A) Zero

(B) Minimum

(C) Maximum

(D) Unity

27. The charge build up in a capacitor is due to

(A) Conduction current

(B) Displacement current

(C) Polarization

(D) Dissipation

28. The transmission coefficient of a wave propagation in the Brewster angle is

(A) Infinity

(B) 0

(C) 1

(D) –1

29. A transmission line has R, L, G and C distributed parameters per unit length of the line, Γ is the propagation constant of the line. Which of the following expressions gives the characteristic impedance of the line ?

(A) $\dfrac{\Gamma}{R+j\omega L}$

(B) $\dfrac{R+j\omega L}{\Gamma}$

(C) $\dfrac{G+j\omega C}{\Gamma}$

(D) $\sqrt{\dfrac{R+j\omega L}{R+j\omega C}}$

30. What will be the reflected wave for an elliptically polarized wave incident on the interface of a dielectric at the Brewster angle ?

(A) Elliptically polarized

(B) Linearly polarized

(C) Right circularly polarized

(D) Left circularly polarized

31. A waveguide can be considered to be analogous to a

(A) Low pass filter

(B) High pass filter

(C) Band pass filter

(D) Band stop filter

32. In free space if $\rho = 0$, the Poisson's equation becomes

(A) Maxwell's divergence equation $\nabla \cdot B = 0$

(B) Laplacian equation $\nabla^2 V = 0$

(C) Kirchhoff's voltage equation $\Sigma V = 0$

(D) None of the above

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

(A) Power density

(B) Radiation resistance

(C) Magnetic energy density

(D) Electric energy density

34. $\nabla \times H = J$ is differential form of

(A) Gáuss' Law

(B) Poisson's equation

(C) Ampere's circuital Law

(D) Laplacian equation

35. A microwave oven irradiates food with electro-magnetic radiation that has a frequency of about 10^{10} Hz. The wavelength of these waves is of the order of

(A) metre

(B) centimeter

(C) millimeter

(D) micrometer

36. An electro-magnetic field is radiated from

(A) Stationary point charge

(B) A capacitor with a voltage

(C) A conductor carrying a DC current

(D) An oscillating dipole

37. The temperature coefficient of resistance of a wire is 0.004/°C. If the resistance of the wire is 4 Ω at 0° C, what the resistance of the wire is at 100° C ?

(A) 4.6 Ω

(B) 5.6 Ω

(C) 6.4 Ω

(D) 4 Ω

38. In a super conductor, if the temperature decreases below its critical temperature, the value of critical magnetic field will be

(A) Increases

(B) Decreases

(C) Not change

(D) Increases or decreases depending on the super conducting material

39. Piezoelectric effect is the production of electricity by

(A) Chemical effect

(B) Pressure

(C) Varying field

(D) Temperature

40. Hall effect can be used to measure

(A) Mobility of semiconductor

(B) Conductivity of semiconductor

(C) Resistivity of semiconductor

(D) All of the above

41. Which of the following statements is correct ?

(A) Hall coefficient of an intrinsic semiconductor is positive.

(B) Hall coefficient of an intrinsic semiconductor is negative.

(C) Hall coefficient of an intrinsic semiconductor is zero.

(D) Hall coefficient of an intrinsic semiconductor is infinity.

42. It is possible to destroy the super conductivity of a material by applying

(A) A strong magnetic field

(B) A temperature much below the transition temperature

(C) A strong electric field

(D) A pressure below that of atmosphere

43. Highest electrical resistivity exists in

(A) Platinum wire

(B) Gold wire

(C) Silver wire

(D) Nichrome wire

44. In a dielectric, the power loss is proportional to

(A) ω

(B) ω^2

(C) $1 / \omega$

(D) $1 / \omega^2$

45. A dielectric material has the real part of the dielectric constant $\left[\epsilon_r^1\right]$ as 5 and its loss tangent is 0.005. The complex dielectric constant $\left[\epsilon_r^*\right]$ is represented by

(A) $5 + j0.025$

(B) $5 - j0.025$

(C) $5 + j0.005$

(D) $5 - j0.005$

46. Which of the following materials is used for the cable insulation ?

(A) Copper

(B) Aluminum

(C) Polytetra fluoroethylene

(D) Polyvinyl chloride

47. The majority charge carriers in P-type semiconductor are

(A) Holes

(B) Free electrons

(C) Ions

(D) Conduction electrons

48. Forbidden energy gap of carbon in diamond structure is

(A) 7.0 eV

(B) 1.0 eV

(C) 0.01 eV

(D) 0 eV

49. A Germanium atom contains

(A) Six valence electrons

(B) Four valence electrons

(C) Only two electron orbits

(D) Three valence electrons

50. In an intrinsic semiconductor there are

(A) No mobile holes

(B) No free electrons

(C) Neither free electrons nor mobile holes

(D) Equal number of free electrons and holes

51. What happens to the resistance of a conductor if its length is increased by 4 times and diameter is reduced to half ?

(A) Resistance is same.

(B) Resistance reduced by 4 times.

(C) Resistance increased by 8 times.

(D) Resistance increased by 16 times.

52. Which of the following materials cannot be used for permanent magnet ?

(A) Alnico

(B) Barium ferrite

(C) Carbon steel

(D) Iron cobalt alloy

53. Hard magnetic material is characterized by

(A) High coercive force and low residual magnetism

(B) Low coercive force and high residual magnetism

(C) Low coercive force and low residual magnetism

(D) High coercive force and high residual magnetism

54. Above Curie temperature the spontaneous polarization of ferro-electric material is

(A) 0

(B) 1

(C) 0.5

(D) Infinity

55. With increase in temperature, magnetic susceptibility of a ferro-magnetic material

(A) Increases

(B) Decreases

(C) Remains constant

(D) Initially increases and then decreases

56. High frequency transformer cores are generally made from

(A) Mu-metal

(B) Mono-metal

(C) Ferrites

(D) Cobalt

57. In a PMMC instrument the damping is provided by

(A) Air friction damping

(B) Fluid friction damping

(C) Eddy current damping

(D) Magnetic damping using magnet

58. A DC voltmeter has a sensitivity of 1000 Ω/V. When it measures half full scale in 100 V scale range, the current through voltmeter is

(A) 100 mA

(B) 1 mA

(C) 0.5 mA

(D) 50 mA

59. A 0 – 300V voltmeter has an error of ± 2% of full scale deflection. What is the range of readings if true value of voltage is 30 V ?

(A) 20 V – 40 V

(B) 24 V – 36 V

(C) 29.4 V – 36.6 V

(D) 24.6 V – 35.4 V

60. Which of the following instruments operates without controlling torque ?

(A) Electrostatic meter

(B) Watt meter

(C) Dynamometer type meter

(D) Power factor meter

61. Which of the following is an active transducer ?

(A) Piezo-electric pressure transducer

(B) Metallic strain gauge

(C) Semiconductor strain gauge

(D) Platinum resistance thermometer

62. Which of the following is basically a current sensitive instrument ?

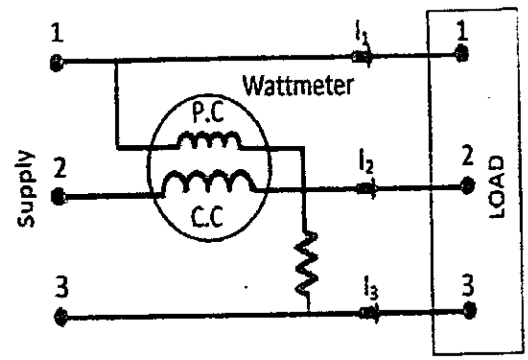
(A) PMMC

(B) CRO

(C) Electrostatic instrument

(D) FET input electronic voltmeter

63. An electro-dynamometer type wattmeter is connected (as shown in fig) in a 3-ϕ supply and having 3-ϕ balanced load. V and I are the values of phase voltage and phase current, θ is phase angle between them. The wattmeter reading will be proportional to



(A) VI cosθ

(B) VI tanθ

(C) VI sinθ

(D) zero

64. Two wattmeter method is used to measure power in balanced 3-ϕ circuit drawing lagging current. The power factor of the load, if one of the wattmeter reading is zero, will be

(A) 0

(B) 0.8

(C) 0.707

(D) 0.5

65. 1-ϕ energy meter having meter constant of 250 rev/kWh is operating at 240V, 50Hz with a load of 15A at UPF for 4 hours. The number of revolutions shown by meter during this period is

(A) 36000

(B) 3600

(C) 360

(D) 36

66. Creeping error may occur in induction type energy meter due to

(A) Incorrect position of brake magnet

(B) Incorrect adjustment of position of shaded band

(C) Over voltage across voltage coil

(D) Increase in temperature

67. Which of the following bridges is used to determine frequency ?

(A) Anderson bridge

(B) Desauty bridge

(C) Campbell bridge

(D) Wien bridge

68. Dielectric loss of a capacitor can be measured by which of the following bridges ?

(A) Wien bridge .

(B) Owen bridge

(C) Schering bridge

(D) Maxwell bridge

69. Potentiometer is basically

(A) Deflection type instrument

(B) Digital instrument

(C) Null type instrument

(D) Deflection as well as null type instrument

70. Q-meter works on the principle of

(A) Mutual inductance

(B) Self inductance

(C) Series resonance

(D) Parallel resonance

71. The errors in the current transformers are mainly due to

(A) Leakage flux

(B) Excitation EMF

(C) Secondary load

(D) Core loss

72. Two equal voltages of same frequency applied to the X and Y plates of CRO, produces a circle on the screen. The phase difference between the two voltages is

(A) 30°

(B) 90°

(C) 60°

(D) 120°

73. A Lissajous pattern on an oscilloscope has 6 horizontal tangencies and 3 vertical tangencies. The frequency of horizontal input is 1000 Hz. The frequency of vertical input is

(A) 2000 Hz

(B) 200 Hz

(C) 5000 Hz

(D) 500 Hz

74. Which of the following measuring devices has minimum loading effect on quantity under measurement ?

(A) PMMC

(B) CRO

(C) Hot wire instrument

(D) Electro-dynamometer

75. A 4 digit DVM (digital voltmeter) with a 100 mV lowest full scale range would have a sensitivity of how much value, while its resolution is 0.001 ?

(A) 0.1 mV ,

(B) 0.01 mV

(C) 1 mV

(D) 10 mV

76. The sensitivity factor of strain gauge is normally of the order of

(A) 1 to 1.5

(B) 1.5 to 2

(C) 0.5 to 1

(D) 5 to 10

77. A synchro is used to

(A) Accelerate the rotating shaft

(B) Convert an angular position of a shaft into an electrical signal

(C) Convert linear motion into angular position

(D) Amplify low frequency signal

78. Which of the following is not an element of electro-pneumatic pressure transmitter ?

(A) LVDT

(B) Bellows

(C) Op-amp

(D) Flapper-nozzle mechanism

79. Doppler shift principle is used in the measurement of

(A) Temperature

(B) Frequency

(C) Speed

(D) Pressure

80. What is the size of the sub matrix "H" of the Jacobian, if n_1 is the number of PV buses and n_2 the number of PQ buses ?

(A) $(n_1 + n_2) \times (n_1 + n_2)$

(B) $(n_1 + n_2)$

(C) $(n_1 + n_2)n_1$

(D) $(n_1 + n_2)n_2$

81. Roots of the characteristic equation gives the

(A) forced response

(B) total response

(C) natural response

(D) Cause of response

82. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at first floor. The bulb can be turn ON and also turned OFF by any one of the switches irrespective of the state of other switch. The logic of switching of the bulb resembles

(A) An AND gate

(B) An OR gate

(C) A XOR gate

(D) A NAND gate

83. A step function is applied to a series RLC circuit having $R = 2\ \Omega$, $L = 1$ H and $C = 1$ F. The transient current response of the circuit would be

(A) Over damped

(B) Under damped

(C) Critically damped

(D) Cannot be said.

84. The process of converting a discrete signal to digital form is known as

(A) Linearization

(B) Sampling

(C) Quantization

(D) None of the above

85. Multiplexer work with

(A) Analog signal

(B) Digital signal

(C) Both analog and digital signals

(D) None of the above

86. Which of the following is analogous to multiplexer ?

(A) Data selector

(B) Data multiplexer

(C) Data filter

(D) All of the above

87. A binary input 000 is fed to a 3bit DAC/ADC. The resultant output is 101. Find the type of error.

(A) Settling error

(B) Gain error

(C) Offset error

(D) Linearity error

88. Find the resolution of a 10-bit AD converter for an input range of 10 V ?

(A) 97.6 mV

(B) 9.77 mV

(C) 0.977 mV

(D) 0.976 mV

89. The value of ramp function $t\,u(t)$ at $t = -\infty$ is

(A) 0

(B) ∞

(C) $-\infty$

(D) 1

90. Which of the following quantity is dimensionally different from the other three ?

(A) $\frac{L}{R}$

(B) RC

(C) $\frac{\omega L}{R}$

(D) $\frac{2\pi}{\omega}$

91. A 30 μF capacitor is connected across an ideal DC voltage source. The current in the capacitor

(A) will be zero at first, then exponentially rise.

(B) will be very high at first then exponentially decay.

(C) will be very high at first then exponentially decay and at steady state becomes zero.

(D) None of the above

92. A network has 12 branches and 8 independent loops. The number of nodes in the network is

(A) 5

(B) 4

(C) 6

(D) 3

93. The RMS value of a given signal $v(t) = 2 + 3\sqrt{2}\cos(10t + 45^\circ) - 3\cos(10t)$ is

(A) 2

(B) $\sqrt{35/2}$

(C) $\sqrt{17/2}$

(D) $\sqrt{17}$

94. Tellegen's theorem is applicable to

(A) Linear networks only

(B) Non-linear networks only

(C) Both linear and non-linear networks

(D) Neither linear nor non-linear networks

95. Two 100 W, 200 V lamps are connected in series across a 200V supply. The total power consumed by each lamp will be

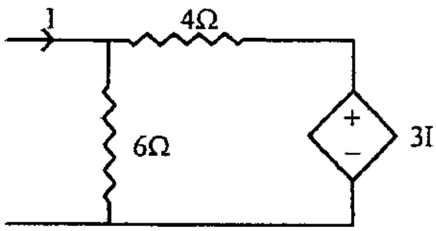
(A) 25 W

(B) 50 W

(C) 100 W

(D) 200 W

96. The circuit shown in Fig. is equivalent to a load of



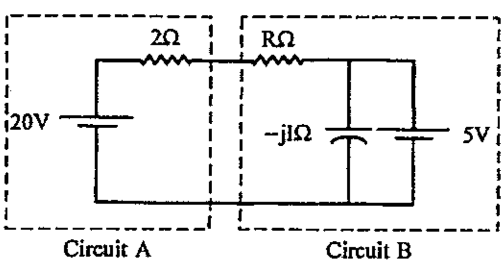
(A) 2.4 Ω

(B) 4.2 Ω

(C) 6 Ω

(D) 10 Ω

97. The value of R for which maximum power is transferred from circuit A to circuit B is



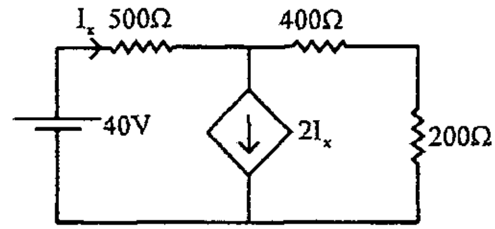
(A) 2 Ω

(B) 1 Ω

(C) 4 Ω

(D) 0.5 Ω

98. In the circuit shown below power delivered or absorbed by the dependent source is



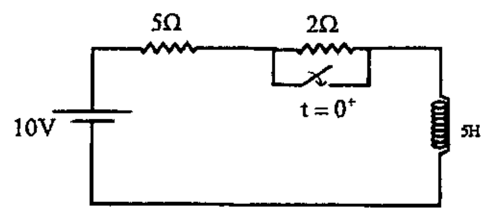
(A) 368 W Delivered

(B) 16 W Absorbed

(C) 192 W Delivered

(D) 40 W Absorbed

99. In the series R-L circuit the switch is closed at t = 0 sec. The value of current at t = 0 sec is



(A) 0 A

(B) 5 A

(C) 2 A

(D) 10/7 A

100. A circuit of R = 2 Ω and L = 1 H is excited by a step voltage of 10 V at t = 0 sec. The current at t = 10 sec

(A) 5 A

(B) 3.16 A

(C) 0.5 A

(D) 0 A