1. Electron mobility of the following intrinsic elements in descending order is:

   (a) GaAs, Ge, Si
   (b) GaAs, Si, Ge
   (c) Si, Ge, GaAs
   (d) Ge, Si, GaAs

2. A sample of Si is doped with 10^{17} donor atoms/cm³. Considering electron mobility in the doped Si 700 cm²/V-sec, the approximate resistivity of the doped Si is:

   (a) 1 Ω-cm
   (b) 10 Ω-cm
   (c) 0.1 Ω-cm
   (d) 100 Ω-cm

3. Common-base current gain of a p-n-p bipolar transistor is 0.99. The common emitter current gain of the transistor is:

   (a) 101
   (b) 0.01
   (c) 99
   (d) 1.0

4. The electrical conductivity of a semiconductor increases when a radiation of wavelength shorter than 1000 nm is incident on it. The band gap of the semiconductor is:

   (a) 2.4 eV
   (b) 1.2 eV
   (c) 3.4 eV
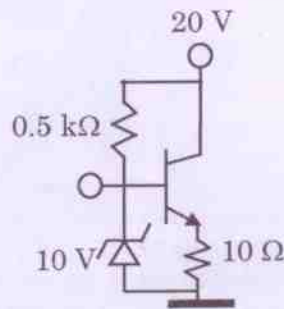   (d) 4.0 eV

5. The voltage across the resistor R is:
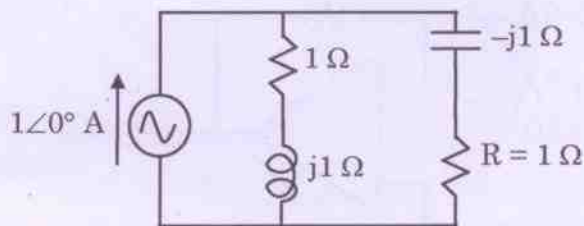
   (a) $1/\sqrt{3}\ \angle 0°$ V
   (b) $1/\sqrt{2}\ \angle 0°$ V
   (c) $1/2\ \angle 45°$ V
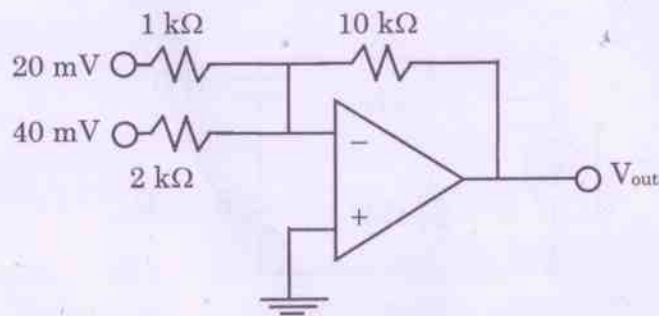   (d) $1/\sqrt{2}\ \angle 45°$ V

6. The effective resistance faced by the voltage source is:

(a) 4 Ω

(b) 12 Ω

(c) 3 Ω

(d) 16 Ω
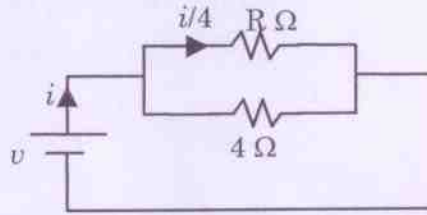
7. Common emitter DC current gain of the transistor is 100. The current through the 10 V Zener diode (assuming V_{BE} of the transistor is 0.7 V) is:
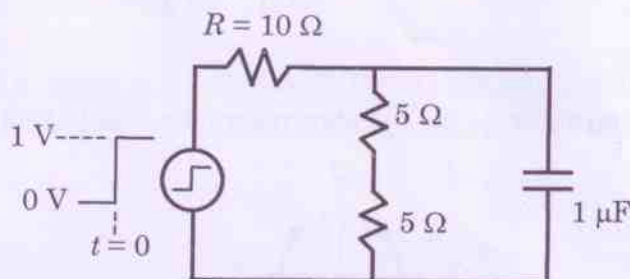

(a) 10.3 mA

(b) 19.3 mA

(c) 20 mA

(d) 40 mA

8. The circuit is with an ideal operational amplifier with ±10 V supply. The output voltage is:

(a) −200 mV

(b) −400 mV

(c) −600 mV

(d) −300 mV

9. A step voltage of 10 V applied to the circuit at $t = 0$. The current through the resistor R just after $t = 0$ and at steady state are:

$R = 10\ \Omega$

1 V----

0 V

$t = 0$

$5\ \Omega$

$5\ \Omega$

$1\ \mu F$

   (a)   100 mA, 50 mA   (b)   50 mA, 50 mA

   (c)   100 mA, 100 mA   (d)   75 mA, 75 mA

10. Which of the following addressing mode is not usable in XCH instruction of 8051 microcontroller?

   (a)   Direct Addressing   (b)   Indirect Addressing

   (c)   Register Addressing   (d)   Immediate Addressing

11. In a binary source, 0s occur three times as often as 1s. What is the information contained in the 1s?

   (a)   0.415 bit   (b)   0.333 bit

   (c)   3 bit   (d)   2 bit

12. Spectrum of a signal $x(t)$, sampled at period T, is given by:

   (a) $X_s(f) = \sum\limits_{n=-\infty}^{\infty} X(f - \frac{n}{T})$ (b) $X_s(f) = \sum\limits_{n=-\infty}^{\infty} X(nf - T)$

   (c) $X_s(f) = X(f - \frac{n}{T})$ (d) $X_s(f) = \sum\limits_{n=-\infty}^{\infty} X(f - nT)$

13. A bandpass signal occupies the bandwidth 390 KHz to 410 KHz. What minimum sampling frequency would you use from the options given below, so as to avoid aliasing?

   (a)   40 KHz   (b)   820 KHz

   (c)   41 KHz   (d)   800 KHz

14. A 12-bit ADC has input signal range of ± 1 V. The signal to quantization noise ratio if a sine wave signal with 0.25 V peak voltage is given as input is:

   (a) 62 dB

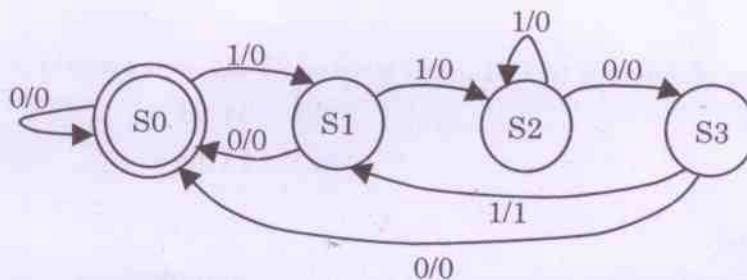   (b) 72 dB

   (c) 74 dB

   (d) 48 dB

15. Identify the modulation schemes for the shown signal constellation diagram
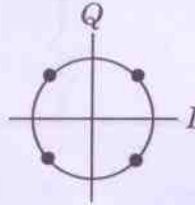
   (a) ASK

   (b) MSK

   (c) FSK

   (d) QAM

16. Which of the following modulation scheme requires minimum power for transmission?

   (a) QPSK

   (b) 8-PSK

   (c) 16-QAM

   (d) 64-QAM

17. Which of the following channel coding scheme helps in correcting burst errors?

   (a) CRC

   (b) Convolution coding

   (c) Viterbi

   (d) Reed-Solomon

18. A 70 MHz carrier is QPSK modulated by a 1.544 Mbps T1 data stream. The transmitter employs a raised-cosine filter with $\alpha = 0.2$. What is the transmitted bandwidth of the signal?

   (a) 3705.6 KHz

   (b) 1852.8 KHz

   (c) 308.8 KHz

   (d) 926.4 KHz

19. If two tones f_1 and f_2 are amplified by a non-linear amplifier, which frequency components would be present in output?

   (a) f_1, f_2

   (b) $f_1, f_2, f_1 + f_2, f_1 - f_2$

   (c) $f_1 + f_2, f_1 - f_2$

   (d) $nf_1 \pm mf_2$, where n and m are integers

20. A phase lock loop with a first order loop filter can track:

    (a) phase offset
    (b) frequency offset
    (c) frequency offset rate
    (d) amplitude variation

21. The noise figure of a device is 2. If input SNR is 37 dB, what would be output SNR?

    (a) 18.5 dB
    (b) 34 dB
    (c) 40 dB
    (d) 74 dB

22. What is the limit of E_b/N_o, below which reliable communication is not possible?

    (a) −10 dB
    (b) −1.6 dB
    (c) 0 dB
    (d) 1.6 dB

23. A satellite communication link has uplink C/No of 50 dB-Hz and downlink C/No of 47 dB-Hz. What would be overall link C/No?

    (a) 44 dB-Hz
    (b) 45 dB-Hz
    (c) 48.5 dB-Hz
    (d) 53 dB-Hz

24. A signal transmitted from an Earth station bounces back from a geostationary satellite, with an altitude of 35864 km from the Earth surface. The range from the Earth station is 38200 km. The round trip time is about: (excluding processing delays and assuming $c = 3 \times 10^8$ m/s)

    (a) 255 ms
    (b) 127 ms
    (c) 239 ms
    (d) 120 ms

25. 1 mW in dBm is:

    (a) 0 dBm
    (b) −30 dBm
    (c) 30 dBm
    (d) 1 dBm

26. Which of the following is not true?

    (a) MPEG-4 is a source coding technique
    (b) Channel coding gives coding gain at the expense of bandwidth
    (c) Source coding/decoding is done to remove errors
    (d) Concatenated coding gives usually good performance

27. The following Finite State Machine (FSM) is used to detect a particular pattern in input data stream. Whenever the pattern is matched at input, output is set to '1' or else output is cleared to '0'. For which of the following data stream, output goes to '1' twice?

S0 →(1/0)→ S1 →(1/0)→ S2 →(0/0)→ S3
S0 self-loop 0/0
S1 →(0/0)→ S0
S2 self-loop 1/0
S3 →(1/1)→ S0
S3 →(0/0)→ S1 (0/0)

(a) 0010011010010101	(b) 0101011000010101
(c) 0011011010010101	(d) 1100100101001010

28. A digital signal processing system is described by the expression:

$$y(n) = 2x(n) + x(n-1) + 2y(n-1)$$

The system is:

(a)   A stable FIR filter
(b)   A stable IIR filter
(c)   An unstable FIR filter
(d)   An unstable IIR filter

29. The rectangular window has relative side-lobe level:

(a) -13 dB
(b) -27 dB
(c) -32 dB
(d) -43 dB

30. Consider the discrete time signal $x(n) = \{1, 1, 1, 1, 0.5, 0.5\}$. $y(n) = \text{conv}(\delta(n-1), x(n))$ is:

(a)   1
(b) $\delta(n-1)$
(c) $x(n-1)$
(d)   5

31. Consider a sequence $x(n) = [2, 4, 6, 8, 0, 1, 3, 5, 7, 9]$. Down-sample the sequence by 3 and then up-sample by 2. The resulting sequence is:

(a)   [2, 0, 0, 0, 7, 0]
(b)   [2, 0, 0, 0, 0, 0, 7, 0, 0]
(c)   [2, 0, 8, 0, 3, 0, 9, 0]
(d)   [2, 2, 8, 8, 3, 3, 9, 9]

32. Power consumed in a CMOS circuit operating at frequency f is proportional to:

    (a) V_{cc}

    (b) $V_{cc}f$

    (c) $V_{cc}^2 f$

    (d) $V_{cc}^2 f^2$

33. The phase velocity of a plane wave given by $E_x = E_0 \cos(\omega t - \beta z)$ with a frequency of 5.0 GHz and a wavelength in the material medium of 3.0 cm is:

    (a) 3.0×10^8 m/sec

    (b) 1.5×10^8 m/sec

    (c) 5×10^8 m/sec

    (d)   None

34. If the reflected wave at the load of a transmission line is 20dB below the incident wave, the SWR at the load is:

    (a)   1.5

    (b)   1.22

    (c)   3.0

    (d)   4.0

35. The highest frequency for which a circular coaxial transmission line having outer diameter = 3.1 mm and inner diameter = 1.3 mm can be operated in pure TEM mode (assuming free space medium between the two conductors) should be less than:

    (a)   12.2 GHz

    (b)   18.6 GHz

    (c)   26.5 GHz

    (d)   43.4 GHz

36. In a communication system at 300 MHz, the receiving antenna gain is 8 dBi, the transmitting antenna gain is 10 dBi and the transmitting power level is 25 watts, the distance between the transmitter and the receiver is 1 km, the power received at the receiving antenna port (assuming the propagation medium is loss-less):

    (a)   1 mW

    (b)   9.97 μW

    (c)   99.7 nW

    (d)   0.0997 nW

37. A rectangular waveguide with air medium has dimensions $a = 22.86$ mm and $b = 10.6$ mm is fed by 3 GHz carrier from a coaxial cable, which of the following is false statement for TE_{01} mode?

    (a)   Propagating mode

    (b)   Non-propagating mode

    (c)   Propagating mode in case filled fully with dielectric material of proper dielectric constant

    (d)   None of the above

38. TM$_{01}$ mode in rectangular perfect metallic waveguide is:

   (a) Propagating mode
   (b) Evanescent mode
   (c) Non-existent mode
   (d) None of the above

39. The directivity of a prime-focal parabolic reflector antenna is 30 dBi. If the efficiency of the antenna is 50%, the gain of the antenna is:

   (a) 27 dBi
   (b) 33 dBi
   (c) 25 dBi
   (d) 80 dBi

40. Ratio of skin depths of an Electromagnetic wave inside the conductor for the corresponding frequencies at 4 GHz and 9 GHz, considering the same material properties for both the frequencies is:

   (a) 9:4
   (b) 4:9
   (c) 3:2
   (d) 2:3

41. A Cassegrain reflector antenna has a sub-reflector whose geometrical shape is:

   (a) Paraboloid
   (b) Hyperboloid
   (c) Ellipsoid
   (d) Spherical

42. The beam-width and the directivity of an antenna are:

   (a) Directly proportional
   (b) Inversely proportional
   (c) Independent of each other
   (d) Equal

43. A lossless transmission line with characteristic impedance $Z_0 = 50$ ohm is 30 m long and operates at 2 MHz. The line is shorted at the load, if the phase velocity = 0.6 times the velocity of light, the input impedance of the line is:

   (a) $75\angle 90°$ ohm
   (b) $\dfrac{50}{\sqrt{3}} \angle 180°$ ohm
   (c) $\dfrac{100}{\sqrt{2}} \angle 180°$ ohm
   (d) $\dfrac{75}{\sqrt{2}} \angle 270°$ ohm

44. Two microwave sub-systems having respective return loss of 10 dB and 20 dB are cascaded together, the return loss at the input of the integrated system is:

(a) 9.63 dB

(b) 15.36 dB

(c) 21.12 dB

(d) 25.23 dB

45. A parabolic reflector antenna used for reception of data is 1 meter in diameter and operates at 30 GHz. The far field distance of this antenna for a quadratic phase error of 22.5 degree is:

(a) 200 meter

(b) 50 meter

(c) 100 meter

(d) 150 meter

46. A potential field is given by $\Phi = 2xy^2 - 3y^2z$. If $\hat{x}, \hat{y}, \hat{z}$ are the unit vectors along x, y and z directions respectively, the field intensity at (0, 1, 0) is:

(a) 0 V/m

(b) $2\hat{x} - 3\hat{z}$

(c) $-2\hat{x} + 3\hat{z}$

(d) $2\hat{x} + 3\hat{z}$

47. The VSWR of a microwave unit is 1.5, the return loss is:

(a) 14 dB

(b) 16 dB

(c) 18 dB

(d) 11 dB

48. In two wire transmission line, two consecutive voltage minima are found at 20.6 cm and 25.6 cm. The operating frequency is:

(a) 3.5 GHz

(b) 3 GHz

(c) 1 GHz

(d) 2.5 GHz

49. A TEM mode transmission line is having distributed circuit parameters as $R = 1$ ohm/m, $L = 200$ nH/m, $G = 300$ μS/m, $C = 60$ pF, the line is:

(a) Loss-less

(b) Lossy

(c) Distortion-less

(d) None of the above

50. A plane wave $E = 100\sin(\omega t - 10x)$ V/m in a loss less medium with $\mu = 4\mu_0$, $\varepsilon = \varepsilon_0$ strikes another medium with 90 degree angle of incidence having $\mu = 9\mu_0$, $\varepsilon = \varepsilon_0$, the reflection co-efficient is:

(a) 0.5

(b) 0.25

(c) 0.1

(d) 0.2

51. What is the functionality of following digital circuit? A is input data, CLK is system clock and Y is output.
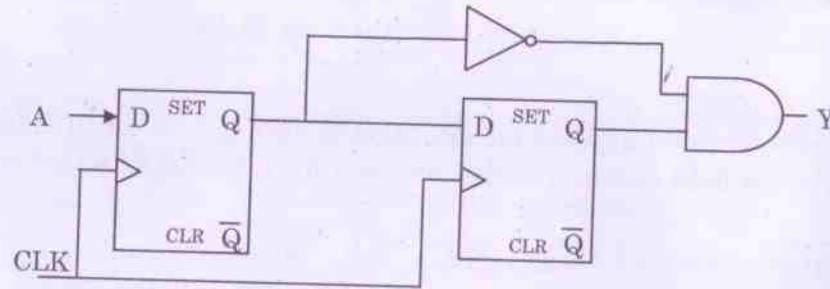
   (a)   Falling edge detection of input A

   (b)   Clock division by 2

   (c)   Rising edge detection of input A

   (d)   Clock division by 4

52. A lossless transmission line has the distributed circuit parameters of inductance and capacitance per meter as 625 nH/m and 64 pF/m respectively, the phase constant of the line at 100 MHz is:

   (a)   3.97 rad/m

   (b)   18.42 rad/m

   (c)   1.56 rad/m

   (d)   9.21 rad/m

53. In the circuit if $C1 = 2\,\mu F$ and $C2 = 3\,\mu F$, the equivalent capacitance between points A and B is:

   (a)   4 μF

   (b)   3 μF

   (c)   1 μF
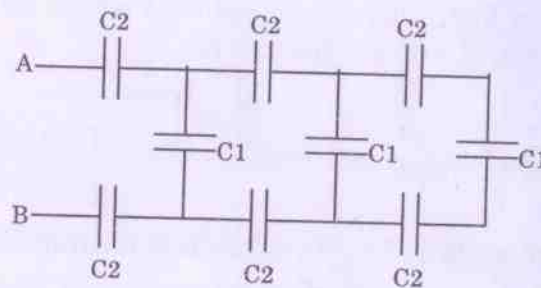
   (d)   2 μF

54. If *n* number of MOSFETs with identical W/L are connected in series, then equivalent W/L is given by:

    (a) $(W/L)^*n$

    (b) $(W/L)/n$

    (c) $(W/L)^*n^2$

    (d) $(W/L)/(n^2)$

55. Which resource of FPGA implements combinational logic functionality?

    (a)   Block RAM

    (b)   Configurable Logic Block (CLB)

    (c)   Routing Switch Matrix

    (d)   All of above

56. What will be the content of Accumulator, Register-B and Overflow Flag (OV) after execution of following 8051 micro-controller assembly code?

    MOV A, #65h
    MOV 0F0h, #14h
    DIV AB
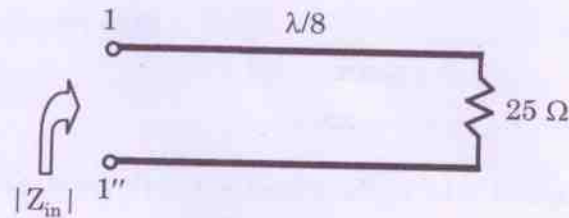   DIV AB

    (a)   A=00h, B=00h, OV=1

    (b)   A=05h, B=00h, OV=0

    (c)   A=00h, B=05h, OV=0

    (d)   A=05h, B=00h, OV=1

57. Average value of the waveform is:
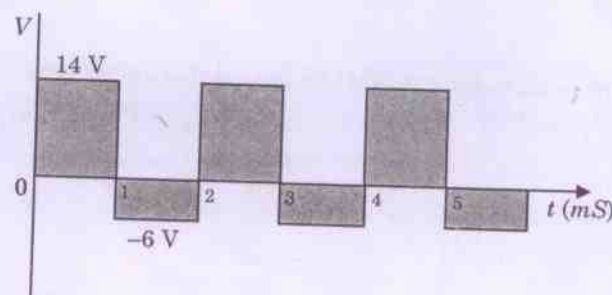
   (a)   8 V

    (b)   20 V

    (c)   10 V

    (d)   4 V

63. Magnitude of input impedance of a $\lambda/8$ lossless 50 Ω transmission line terminated with 25 Ω is:

(a) 100 Ω

(b) 25 Ω

(c) 50 Ω

(d) None of the above

64. Pipelining technique is used in microprocessor to improve which of the following parameter?

(a) Power dissipation

(b) Interrupt latency

(c) Die size

(d) Maximum clock frequency

65. In case of an ideal Class-F microwave power amplifier, time domain voltage and current waveform of the device have:

(a) 50% overlap

(b) Maximum overlap

(c) No overlap

(d) Less than 80% overlap

66. Reason for superior high frequency performance of metal-semiconductor diode compared to p-n junction diode is:

(a) Higher conductivity of metal compared to semiconductor

(b) No minority carrier storage effect in metal-semiconductor diode

(c) Metal semiconductor junction does not rectify RF signal

(d) Hole is the majority carrier in Schottky barrier diode operation

67. Which of the following diodes is most suitable for detection of microwave signal?

(a) P-I-N diode

(b) Schottky barrier diode

(c) Varactor diode

(d) P-N junction diode

68. Which device is suitable for higher order RF frequency multiplier?

    (a)   P-I-N diode   (b)   P-N junction diode

    (c)   BJT   (d)   Step recovery diode

69. Input reflection coefficient 'S11' of the 2-port network for 50 Ω system is:
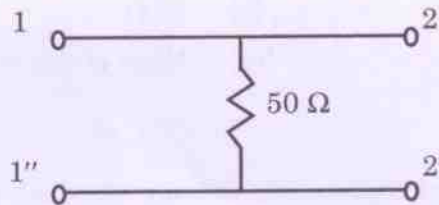
    (a) $1/3 \angle 0°$ (b) $1/2 \angle 180°$

    (c) $1/3 \angle 180°$ (d) $1/2 \angle 0°$

70. The graph below shows operating load line and I-V characteristic of a Schottky diode at two different RF power levels. Under this bias condition RF resistance of the diode:
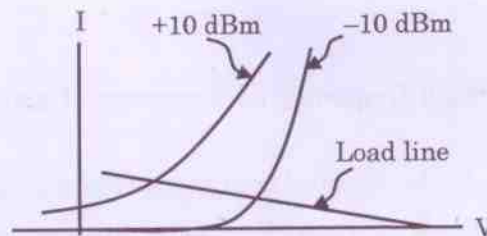

    (a)   Remains constant with the RF power level

    (b)   Decreases with the increase of RF power level

    (c)   Increases with the increase of RF power level

    (d)   None of the above

71. A BJT is having common emitter current gain 100. Considering 10 V supply and $V_{BE} = 0.7$ V what will be the value of R_C and R_B to set the quiescent point at $I_C = 10$ mA and $V_{CE} = 8$ V ?
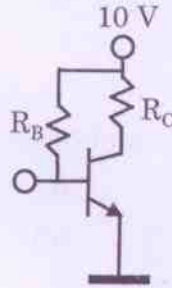
(a) $R_C = 200\ \Omega$, $R_B = 93\ k\Omega$

(b) $R_C = 2\ k\Omega$, $R_B = 100\ k\Omega$

(c) $R_B = 83\ k\Omega$, $R_C = 100\ \Omega$

(d) $R_C = 20\ \Omega$, $R_B = 93\ k\Omega$

72. Which statement is false about microstrip line over stripline?

(a) Less radiative

(b) Easier for component integration

(c) One sided ground plane

(d) More interaction with neighboring circuit element

73. A high gain MESFET packaged device of case-to-channel thermal resistance of the device is 4.5°C/Watt provides 8 W RF output power taking 20 W DC power. What will be the channel temperature of the device if the case temperature of the device maintained at 55°C?

(a) 109°C

(b) 145°C

(c) 59.5°C

(d) 91°C

74. For a class-A FET power amplifier with 10 V drain supply and 2 A drain current bias providing RF load current of 1 A amplitude. What is the DC to RF efficiency for load resistance of 5 Ω?

   (a) 50%

   (b) 25%

   (c) 35%

   (d) 12.5%

75. DC to RF efficiency of an ideal class-F amplifier is:

   (a) 100%

   (b) 78.4%

   (c) 50%

   (d) < 80%

76. A unilateral transistor has an output impedance $Z_{out} = (10 - j10)\ \Omega$. Value of the series and shunt components of the matching network for complex conjugate match at the output of the device to 50 Ω load are:
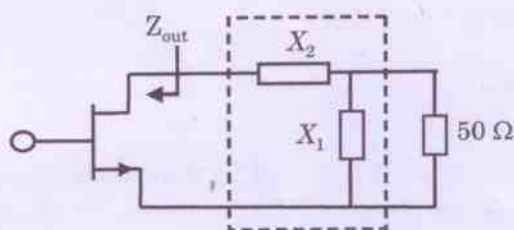

   (a) $X_1 = -j25,\ X_2 = +j30$

   (b) $X_1 = +j25,\ X_2 = +j30$

   (c) $X_1 = -j25,\ X_2 = -j3$

   (d) $X_1 = +j2,\ X_2 = -j30$

77. A communication channel is having a bandwidth of 3000 Hz. The transmitted power is such that the received Signal-to-Noise ratio is 1023. The maximum data rate that can be transmitted t error-free through the channel is:

   (a) 3 Kbps

   (b) 30 Kbps

   (c) 3 Mbps

   (d) 300 Kbps

78. A CDMA system requires E_b/I_o of 10 dB. Each of the transmitters in the network transmits data at the rate of 1 Kbps with a PN chip rate of 1 Mbps. The maximum number of such users that the network can support is:

(a) 20

(b) 30

(c) 1000

(d) 100

79. Laplace transform of $e^{\theta t} \sin(\omega t)$ is:

(a) $\dfrac{\theta}{S^2 + \omega^2}$

(b) $\dfrac{\omega}{(S - \theta)^2 + \omega^2}$

(c) $\dfrac{S}{S^2 - (\theta - \omega)^2}$

(d) $\dfrac{\omega}{(S + \theta)^2 - \omega^2}$

80. Under steady state condition, the energy stored in the circuit is:
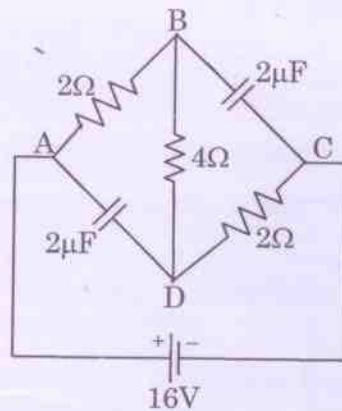
(a) 8.22×10^{-6} J

(b) 1.48×10^{-6} J

(c) 2.88×10^{-4} J

(d) 4.81×10^{-4} J