Ph. D. Entrance Test – 2015
Subject: Electronics and Communication Engineering
Paper – I

Important: *Please consult your Admit Card/Roll No. slip before filling your Roll Number on the Test Booklet and Answer Sheet.*

Roll No.	*In Figure*	*In Words*

O.M.R. Answer Sheet Serial No.

Signature of Candidate: _____   *Signature of Invigilator:* _____

Time: 60 Minutes   Number of Questions: 50   Maximum Marks: 50

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.

INSTRUCTIONS:

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. Please check that this Question Booklet contains **50** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
5. Each question has four alternative answer (A,B,C,D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen. There shall be no negative marking for wrong answers.**
6. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Booklet. No marks will be deducted in such cases.
7. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. The Answer Sheet is designed for computer evaluation. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e. not following the instructions completely, shall be of the candidate only.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so would be expelled from the examination.
13. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
14. **Communication equipment such as mobile phones, pager, wireless set, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. Use of calculators is not allowed.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

1. 11001, 1001 and 111001 correspond to the 2's complement representation of the following set of numbers
   A) 25, 9 and 57 respectively
   B) -6, -6 and -6 respectively
   C) -7, -7 and -7 respectively
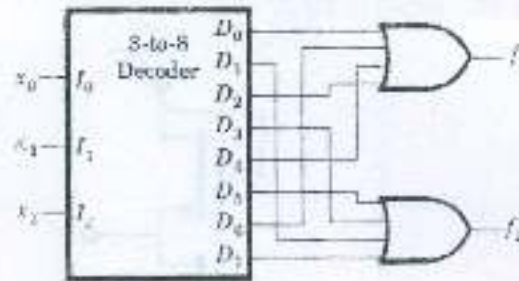   D) -25, -9 and -57 respectively

2. The output $f_1 f_2$ for fig. 1 is

Fig. 1

A) $x_0 c_1 x_2$
B) $x_0 + x_1 + x_2$
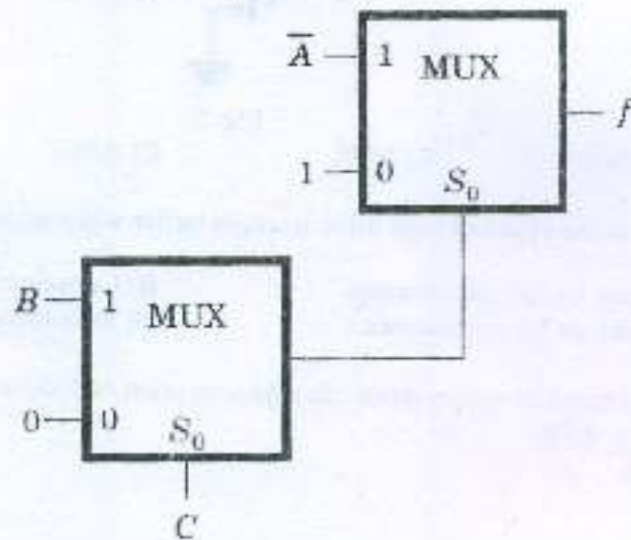C) 1
D) 0

3. The network shown in fig 2. implements

Fig. 2

A) NOR gate
B) NAND gate
C) XOR gate
D) XNOR gate

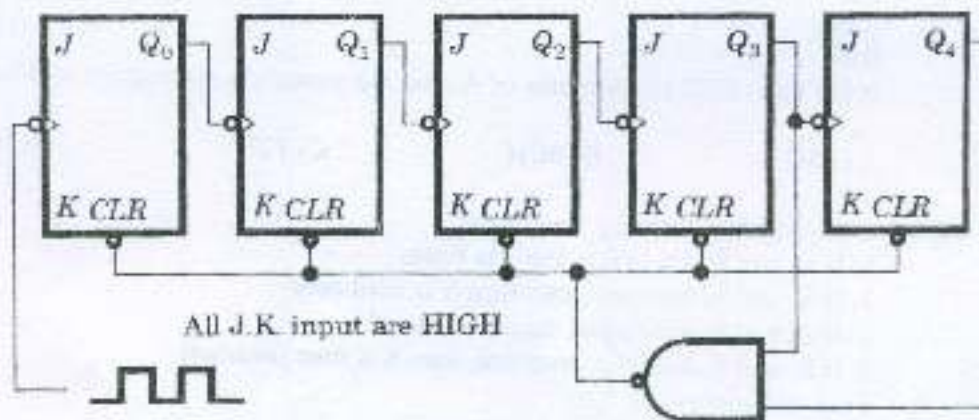4. The mod-number of the asynchronous counter shown in fig. 3 is

All J.K. input are HIGH

Fig. 3

(A) 24
B) 48
C) 25
D) 36

5. The frequency of the pulse at z in the network shown in fig. 4 is
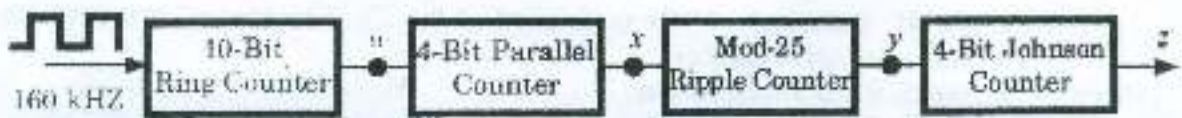

Fig. 4

   A) 10 Hz   B) 160 Hz   C) 40 Hz   D) 5 Hz
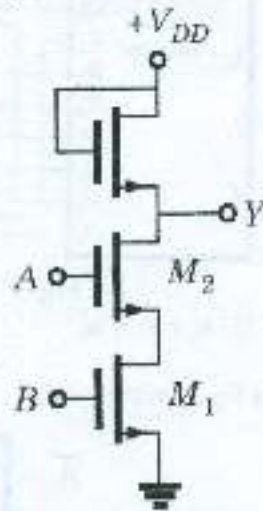
6. Consider the DL circuit of fig 5.

Fig. 5

   A) NAND   B) NOR   C) AND   D) OR

7. What is the effect of high drive strength buffer when added in long net?

   A) Delay on the net increases   B) Capacitance on the net increases
   C) Delay on the net decreases   D) Resistance on the net increases

8. The contents of accumulator after the execution of following instruction will be
MVI A, A7H
ORA A
RLC

   A) CFH   B) 4FH   C) 4EH   D) CEH

9. Consider the following program
MVI A, BYTE1
RRC
RRC
If BYTE1=32H, the contents of A after the execution of program will be

   A) 08H   B) 8CH   C) 12H   D) None of these

10. Consider the following statements
1. If S_1 and S_2 are linear, the S is linear
2. If S_1 and S_2 are nonlinear, then S is nonlinear
3. If S_1 and S_2 are causal, then S is causal
4. If S_1 and S_2 are time invariant, then S is time invariant
True statements are:

   A) 1, 2, 3   B) 2, 3, 4   C) 1, 3, 4   D) All

11. A stable system has input $x(t)$ and output $y(t) = e^{-2t} \cos t\ u(t)$. The impulse response of the system is

A) $\delta(t) - (e^{-2t}\cos t + e^{-2t}\sin t)\ u(t)$

B) $\delta(t) - (e^{-2t}\cos t + e^{-2t}\sin t)\ u(t-2)$

C) $\delta(t) - (e^{2t}\cos t - e^{2t}\sin t)\ u(t)$

D) $\delta(t) - (e^{2t}\cos t + e^{2t}\sin t)\ u(t+2)$

12. $X(z)$ of a system is specified by a pole zero pattern in fig 6.

Fig. 6

Consider three different solution of $x[n]$

$$x_1[n] = \left[2^n - \left(\frac{1}{3}\right)^n\right] u(n)$$

$$x_2[n] = -2^n u[n-1] - \frac{1}{3^n} u[n]$$

$$x_3[n] = -2^n u[n-1] + \frac{1}{3^n} u[-n-1]$$

Correct solution is

A) $x_1[n]$ B) $x_2[n]$ C) $x_3[n]$ D) All three

13. The normalized frequency of a step index fiber is 28 at 1300 nm wavelength. What is the total number of guided modes that can be supported by the fiber.

A) 50 B) 200 C) 400 D) 800

14. Leakage power is inversely proportional to ___.

A) Frequency B) Load Capacitance

C) Supply voltage D) Threshold Voltage

15. In the question, the Fourier Series coefficient of time-domain signal has been given. Determine the corresponding time domain signal and choose correct option. $X[k]$ as depicted in fig. 7, $\omega_o = \pi$
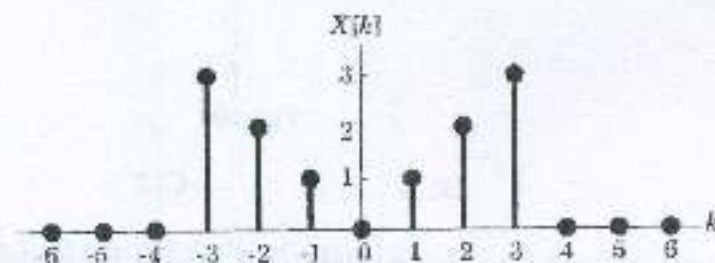

Fig. 7

A) $3\cos(3\pi t) + 2\cos(2\pi t) + \cos(\pi t)$

B) $3\sin(3\pi t) + 2\sin(2\pi t) + \sin(\pi t)$

C) $6\sin(3\pi t) + 4\sin(2\pi t) + 2\sin(\pi t)$

D) $6\cos(3\pi t) + 4\cos(2\pi t) + 2\cos(\pi t)$

(3)

16. A feedback control system shown in fig. 8 is subjected to noise N(s).
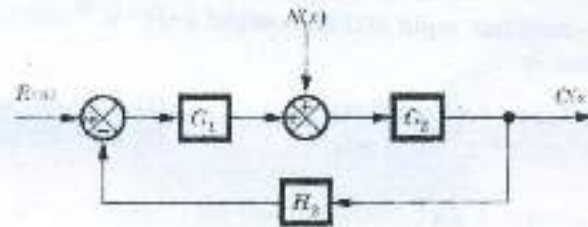

Fig. 8

The noise transfer function $\frac{C_N(s)}{N(s)}$ is

A) $\frac{G_2}{1+G_1G_2H_2}$

B) $\frac{G_2}{1+G_1H_2}$

C) $\frac{G_1}{1+G_2H_2}$

D) None of the above

17. Which transistor element is used in CMOS logic?

A) FET   B) MOSFET   C) Bipolar   D) Unijunction
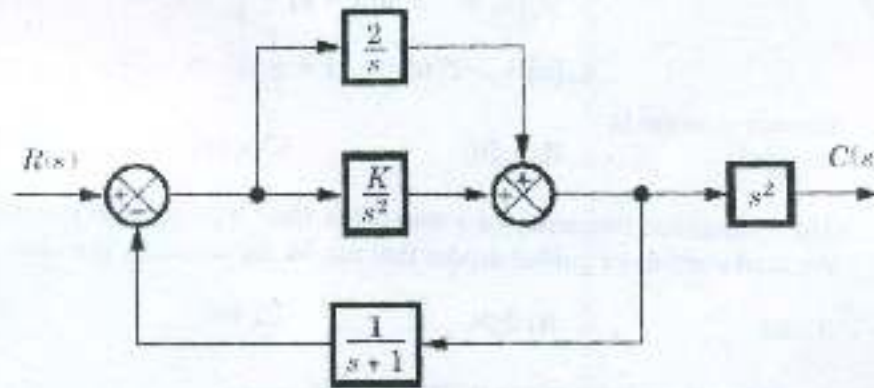
18. A feedback system is shown in fig. 9.

Fig. 9

The poles location for this system is shown in fig. 10 below. The value of K is

Fig. 10

A) 4   B) -4   C) 2   D) -2

19. A thin resistive film having length (l), width (w) and thickness (t) is used as a resistor (R_1) for conducting current in the direction of l. if the film is connected to serve as a resistor (R_2) for conducting current in the direction of w, then what is the value of R_1/R_2?

A) l/w B) w/l C) l^2/w^2 D) w^2/l^2

(4)

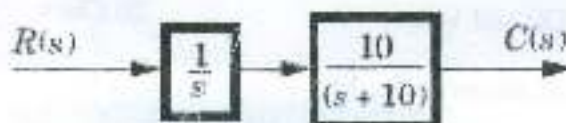20. A system is shown in fig. 11. The rise time and settling time for this system is

Fig. 11

A) 0.22s, 0.4s   B) 0.4s, 0.22s
C) 0.12s, 0.4s   D) 0.4s, 0.12s

21. In the system shown in fig. 12, $r(t) = 1 + 2t,\ t > 0$. The steady state error $e(t)$ is equal to

Fig. 12

A) 1/5   B) 5   C) 0   D) ∞

22. The gain-phase plots of open-loop transfer function of four different systems are shown in fig. 13. The correct sequence of the increasing order of stability of these four systems will be
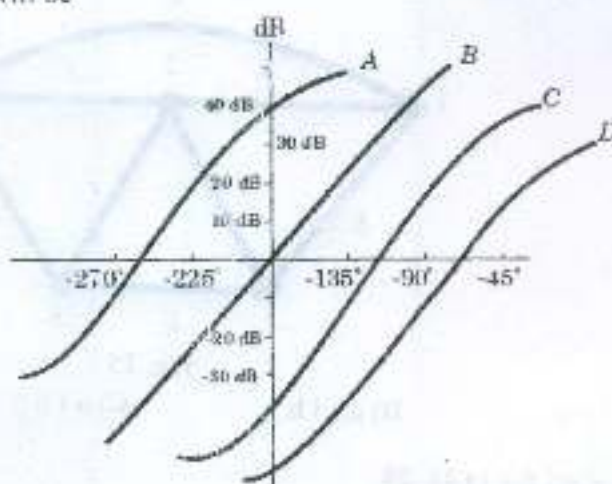

Fig. 13

A) D, C, B, A   B) A, B, C, D   C) B, C, A, D   D) A, D, B, C

23. If the gain margin of a certain feedback system is given as 20 dB, the Nyquist plot will cross the negative real axis at the point

A) s = - 0.05   B) s = - 0.2   C) s = - 0.1   D) s = - 0.01

24. How can eddy current loss in the core of a transformer be minimized?

1. By increasing the resistivity of the core
2. By using the laminated sheets with insulator coatings
3. By using highly insulating non-magnetic material for the core
4. By using the paramagnetic material as the core

Select the correct answer using the code given below:

A) 1 and 2   B) 2 and 3   C) 1 and 3   D) 1, 2, and 4

25. To avoid cross talk, the shielded net is usually connected to ___.

    A) VDD   B) VSS

    C) Both VDD and VSS   D) Clock

26. In the circuit shown in fig. 14
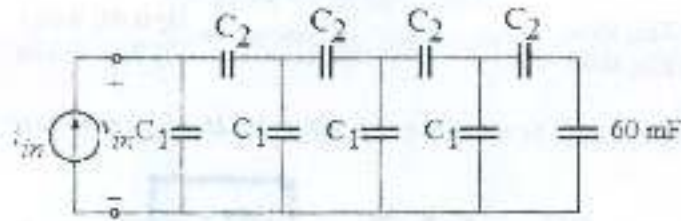
$$i_{in}(t) - 300 \sin 20t \text{ mA, for } t \geq 0.$$

Fig. 14

Let $C_1 = 40 \ \mu F$ and $C_2 = 30 \ \mu F$. All capacitors are initially uncharged. The $v_n(t)$ would be

    A) $0.25\cos 20t$ V   B) $0.25\cos 20t$ V

    C) $-36\cos 20t$ mV   D) $36\cos 20t$ mV
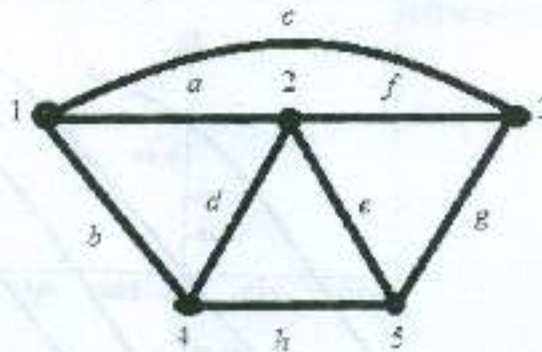
27. A tree of the graph shown in fig. 15 is

Fig. 15

    A) a d e h   B) a c f h   C) a f h g   D) a c f g

Statement for Q.28–29

Branch current and loop current relation are expressed in matrix form as

$$
\begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ i_4 \\ i_5 \\ i_6 \\ i_7 \\ i_8 \end{bmatrix} =
\begin{bmatrix}
0 & 0 & 1 & 0 \\
-1 & -1 & -1 & 0 \\
0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 \\
0 & 0 & -1 & -1 \\
1 & 1 & 0 & -1 \\
1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix} I_1 \\ I_3 \\ I_5 \\ I_6 \end{bmatrix}
$$

where i_j represent branch current and I_k loop current.

28. The rank of incidence matrix is

A) 4   B) 5   C) 6   D) 8

29. A source deliver symbols X_1, X_2, X_3 and X_4 with probabilities 1/2, 1/4, 1/8, and 1/8 respectively. the entropy of the system is

A) 1.75 bits per second   B) 1.75 bits per symbol
C) 1.75 symbols per second   D) 1.75 symbol per bit

30. Communication satellites are allotted bandwidth of 500 MHz. This can be increased by using

A) Frequency and polarization re-use   B) Time division multiplexing

C) Frequency division multiplexing   D) Triple modular redundancy

31. In the circuit shown in fig. 3 a steady state has been established before switch closed. The $i(t)$ for $t > 0$ is

A) $0.73e^{-2t} \sin 458t$ A   B) $0.89e^{-2t} \sin 6.38t$ A

C) $0.73e^{-2t} \sin 458t$ A   D) $0.89e^{2t} \sin 6.38t$ A

32. The entropy of a digital source is 2.7 bits/symbol. It is producing 100 symbols per second. The source is likely to be which one of the following:

A) A binary source   B) A quaternary source

C) An octal source   D) A hexadecimal source

33. A thin film resistor is to be made from a GaAs film doped n–type. The resistor is to have a value of 2 kΩ. The resistor length is to be 200 μm and area is to be 10^{-6} cm². The doping efficiency is known to be 90%. The mobility of electrons is 8000 cm²/Vs. The doping needed is

A) 8.7×10^{15} cm⁻³   B) 8.7×10^{21} cm⁻³

C) 4.6×10^{15} cm⁻³   D) 4.6×10^{21} cm⁻³

34. In the voltage regulator circuit in fig. 16 the power rating of Zener diode is 400 mW. The value of R_L that will establish maximum power in Zener diode is
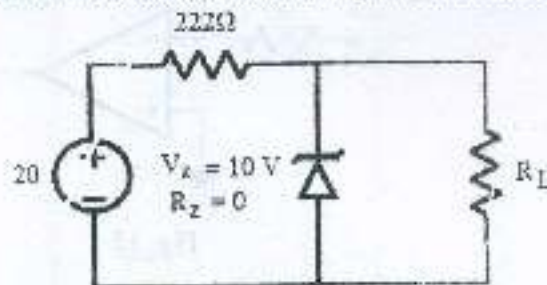

Fig. 16

A) 5 kΩ   B) 2 kΩ   C) 10 kΩ   D) 8 kΩ

35. On which of the following parameters does the maximum range of detection (by radar) for an isolated objection space depend?

1. Wavelength (as $\sqrt{\lambda}$)
2. Minimum detectable echo pulse power
3. Antenna gain (as reciprocal of gain)
4. Transmitted power
5. Radar cross section of the target

Select the correct answer using the code given below:

A) 1, 2 and 3   B) 2, 4 and 5   C) 3, 4 and 5   D) 1, 3 and 5

Statement for Question 36-37

A signal has a bandwidth of 1 MHz. It is sampled at a rate 50% higher than the Nyquist rate and quantized into 256 level using a μ-low quantizer with $\mu = 225$.

36. The signal-to-quantization-noise ratio is

A) 34.91 dB   B) 38.06 dB   C) 42.05 dB   D) 48.76 dB

37. It was found that a sampling rate 20% above the rate would be adequate. So the maximum SNR, that can be realized without increasing the transmission bandwidth, would be

A) 60.4 dB   B) 70.3 dB   C) 50.1 dB   D) None of these

38. A super heterodyne receiver uses an IF frequency of 455 kHz. The receiver is tuned to a transmitter having a carrier frequency of 2400 kHz. High-side tuning is to be used. The image frequency will be

A) 2855 kHz   B) 3310 kHz   C) 1845 kHz   D) 1490 kHz

39. The analog multiplier X of fig. 17 has the characteristics $v_p = v_1 v_2$. The output of this circuit is

A) $v_x v_{ss}$ B) $-v_x v_{ss}$ C) $-(v_x/v_{ss})$ D) (v_x/v_{ss})
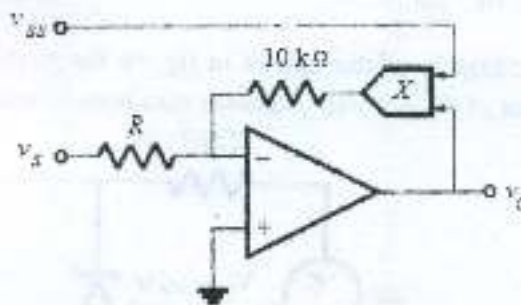

Fig. 17

40. In optical communication, wavelength 1550 nm is used nowadays. What is/are the possible reason(s)?

  1. Dispersion is very low
  2. Loss is very low
  3. WDM and optical amplification are feasible

  Select the correct answer from the codes given below:

  A) 1, 2, and 3   B) 2 only   C) 1 only   D) 1 and 3 only

41. For the circuit in fig. 18 the transistor parameter are $V_{TN} = 0.8$ V and $k_n' = 30$ μA/V^2. If output voltage is $V_o = 0.1$ V, when input voltage is $V_i = 4.2$ V, the required transistor width-to-length ratio is
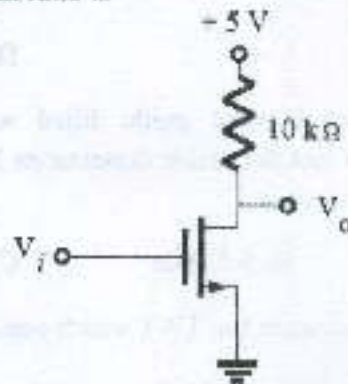

Fig. 18

  A) 1.568   B) 0.986   C) 0.731   D) 1.843

42. In parametric amplifier used in microwave communication systems, the gain is mainly restricted by

  A) Ambient temperature   B) Pump frequency

  C) Pump bandwidth   D) Pump energy

Statement for Q.43-44

An L-band pulse radar has common transmitting and receiving antenna. The antenna having directive gain of 36 dB operates at 1.5 GHz and transmits 200 kW. The object is 120 km from the radar and its scattering cross section is 8 m^2.

43. The magnitude of the incident electric field intensity of the object is

  A) 1.82 V m   B) 2.46 V m   C) 0.34 V m   D) 0.17 V m

44. The magnitude of the scattered electric field at the radar is

  A) 18 μW   B) 12 μW   C) 17 mW   D) 126 mW

45. A direct sequence spread binary phase-shift keying system uses a feedback shift register of Length 19 for the generation of PN sequence. The system is required to have an average probability of symbol error due to externally generated interfering signals that does not exceed 10^{-5}. The processing gain of system is

  A) 37 dB   B) 43 dB   C) 57 dB   D) 93 dB

46. The signal $m(t) = \cos 2000\pi t + 2 \cos 4000t$ is multiplied by the carrier $c(t) = 100 \cos 2\pi f_c t$ where $f_c = 1$ MHz to produce the DSB signal. The expression for the upper side band (USB) signal is

A) $100 \cos(2\pi(f_c + 1000)t) + 200 \cos(2\pi(f_c - 200)t)$

B) $100 \cos(22\pi(f_c - 1000)t) + 200 \cos(2\pi(f_c - 2000)t)$

C) $50 \cos(2\pi(f_c + 1000)t) + 100 \cos(2\pi(f_c + 2000)t)$

D) $50 \cos(2\pi(f_c - 1000)t) + 100 \cos(2\pi(f_c - 100)t)$

47. In PCM system, if the quantization levels are increased from 2 to 8, the relative bandwidth requirement will.

A) Remain same   B) Be doubled

C) Be tripled   D) Become four times

48. A rectangular metal wave guide filled with a dielectric material of relative permittivity $\varepsilon_r = 4$ has the inside dimensions 3.0 cm x 1.2 cm. The cut-off frequency for the dominant mode is

A) 2.5 GHz   B) 5.0 GHz   C) 10.0 GHz   D) 12.5 GHz

49. To prevent oscillations in the TWT which one of the following is resorted to?

A) Bunching defocusing mechanism is used

B) Attenuator is used

C) External magnetic field is provided

D) Helix is used

50. A geostationary satellite locate at about 35000 km from earth can cover

A) Complete surface of the earth   B) one hemisphere in one pass

C) One side of the earth   D) An area depending on antenna used

x-x-x