EC Objective Paper II (Set - D)

1. Techniques that automatically move program and data blocks into the physical main memory when they are required for execution are called

(A) Main Memory techniques (B) Virtual memory techniques

(C) Cache memory techniques (D) Associate mapping techniques

Key: (B)

Exp: Techniques that automatically move program and data blocks into the physical memory when they are required for execution are called **virtual memory technique** Because When a program doesn't completely fit into the main memory, the parts of it not currently being executed are stored on secondary storage devices, such magnetic disks. Of course, all parts of a program that are eventually are first brought into the main memory. When a new segment of a program is to be moved into a fully memory, it must replace another segment already in the memory. In modern computers, operating system moves programs and data automatically between the main memory and secondary storage.

2. Minimum sampling frequency required to reconstruct

$$y(t) = 0.5\left[\frac{\sin 2\pi 1000t}{\pi t}\right]^3 + 0.7\left[\frac{\sin 2\pi 100t}{\pi t}\right]^2 \text{ is}$$

(A) 1×10^3 Hz (B) 2×10^3 Hz (C) 4×10^3 Hz (D) 6×10^3 Hz

Key: (D)

Highest frequency is 3000 Hz So, nyquist rate is 6000 Hz

3. In a microprocessor, WAIT states are used to

(A) Make the processor WAIT during a DMA operation

(B) Make the processor WAIT during an interrupt processing

(C) Make the processor WAIT during a power shut down

(D) Interface SLOW peripheral to the processor

Key: (D)

4. A register of microprocessor which keeps track of the execution of a program and which contains the memory address of the next instruction to be executed is called

(A) Index registers (B) Memory address register

(C) Program counters (D) Instruction register

Key: (C)

5. Which of the following statements are correct?

1. DRAM offers reduced power consumption
2. An associative memory is cheaper than RAM
3. The fastest and most flexible cache organization uses content addressable memory
4. The address generated by a segmented program is called a physical address.

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

Key: (A)

Exp: Statement 1 is CORRECT. The SRAM requires constant power supply, which means this type of memory consumes more power, whereas, the DRAM offers reduced power consumption, due to the fact that the information is stored in the capacitor.

Statement 2 is INCORRECT An associative memory is more expensive than RAM, as each cell must have storage capability as well as logic circuits for matching its content with an external argument. Associative memories are expensive compared to RAMs because of the add logic associated with each cell.

Statement 3 is CORRECT. **Associative Memory is also called as Content Addressable Memory because its memory unit is accessed by its content.** The fastest and most flexible cache organization uses Associative Memory (or) content addressable memory

Statement 4 is INCORRECT. The address generated by a segmented program is called "Logical Address".

6. What is the activity of the microprocessor 8086/8088 when the signals $\overline{SS_0}$, $DT/\overline{R}$ and $IO/\overline{M}$ are 1, 0 and 1 respectively in minimum mode?

(A) Read memory (B) Read I/O port

(C) Code Access (D) Write I/O port

Key: (B)

7. OS that permits multiples programs to be run simultaneously using a single processor is referred to as

(A) Multitasking (B) Multithreading

(C) Multi-user (D) Multi-processing

Key: (A)

Exp: A single-tasking system can only run one program at a time, while a multi-tasking operating system allows more than one program to be running in concurrency. This is achieved by time-sharing, dividing the available processor time between multiple processes which are each interrupted repeatedly in time-slices by a task scheduling subsystem of the operating system. Multi-tasking may be characterized in pre-emptive and co-operative types.

8. In mode 0, Interrupt on terminal count of 8253, if the gate pin is made low while counter is determining, which one of the following operations will follow?

(A) Counter stops and cleared to '0' and starts decrementing when gate pin is made high

(B) Counter stops and thereafter it increments till gate pin='1'high.

(C) Counter stops, the current contents are held and the decrement operations resumes only after gate pin is made high

(D) Counter stops, the current contents are held for one clock cycle and the decrement operation resumes

Key: (C)

9. With respect to the default IR7 routine in 8259 PIC, which of the following statements are correct?
   1. Default CALL to the IR7 routine when an invalid interrupt occurs at IR pin.
   2. A default IR7 CALL does not set the corresponding ISR bit.
   3. A default IR7 routine is nothing but the same valid IR7 routine with lowest

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

Key: (A)

10. In a microprocessor system with memory mapped I/O
    (A) Devices have 8-bit addresses
    (B) Devices are accessed using IN and OUT instructions
    (C) There can be a maximum of 256 input devices and 256 output devices
    (D) Arithmetic and logic operations can be directly performed with the I/O data

Key: (D)

11. In a microprocessor when a CPU is interrupted, it
    (A) Stops execution of instructions
    (B) Acknowledge interrupt and branches of subroutine
    (C) Acknowledges interrupt and continues
    (D) Acknowledge interrupt and waits for the next instruction from the interrupting device

Key: (B)

12. Consider the following statements:
    The advantage of cycle stealing in DMA is that
    1. It increase the maximum I/O transfer rate
    2. It reduces the interference by the DMA controller in the CPU's memory access
    3. It is beneficially employed for I/O device with shorter bursts of data transfer.

    Which of the above statements are correct?
    (A) 1 and 2 only (B) 1 and 3 only
    (C) 2 and 3 only (D) 1, 2 and 3

Key: (D)

Exp: .

Statement2 is CORRECT. This method reduces the interference by the DMA controller in the CPU's memory access.

Statement2 is CORRECT It is beneficially employed for I/O device with shorter bursts of data transfer

13. D input of a clocked D-flip-flop receives an input $A \oplus Q_n$ where A is an external logic input and Q_n is the output of the nth D-FF before the clock appears. The circuit works as
    (A) EX OR gate (D) T-FF
    (C) D-FF (D) JK-FF

Key: (D)

14. Which one of the following is the correct answer when 11011_2 is subtracted from 11101_2 by using the 1's complement method?

(A) 01001 (B) 10001 (C) 00011 (D) 00010

Key: (D)

Exp: Let $Q = (11011)_2$

$P = (11101)_2$

$$\text{Subtraction } = P - Q$$
$$= P + (\text{1's complement of } Q)$$
$$= 11101$$

00100

00001

1

00010

15. An Excess-3 code arithmetic operation is used to perform the

(A) Binary addition (B) Binary subtraction

(C) BCD addition (D) BCD subtraction

Key: (C)

16. Convert the decimal 41.6875 into octal

(A) 51.54 (B) 51.13 (C) 54.13 (D) 51.51

Key: (A)

Exp: $(41.6875)_{10} \to (51.54)_8$

17. If the variance σ_x^2 of $y(n) = X(n) - X(n-1)$ is one-tenth the variance σ_x^2 of a stationary zero-man discrete-time signal X(n), then the normalized autocorrelation function $R_{XY}(K)/\sigma_x^2$ at K = 1 is

(A) 0.95 (B) 0.90 (C) 0.10 (D) 0.05

Key: (A)

Exp: Given $\sigma_y^2 = \frac{1}{10}\sigma_x^2, E[x] = 0$

$$\sigma_y^2 = E\left[\left[x(n) - x(n-1)\right]^2\right] - 0$$
$$= E\left[x^2(n)\right] + E\left[x^2(n-1)\right] - 2\left[x(n)x(n-1)\right]$$
$$= 2\sigma_x^2 - 2R_{xx}(1)$$
$$2R_{xx}(1) = 2\sigma_x^2 - \frac{1}{10}\sigma_x^2$$
$$R_{xx}(1) = \sigma_x^2 - 0.05\sigma_x^2$$
$$= 0.095\sigma_x^2$$
$$\frac{R_{xx}(1)}{\sigma_x^2} = 0.95$$

Directions: Each of the next **three (03)** items consists of two statements, one labeled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below.

Codes:

(A) Both Statements (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(B) Both Statements (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)

(C) Statement (I) is true but Statement (II) is false

(D) Statement (I) is false but Statement (II) is true

18. Statement (I): A differential amplifier is used at the input stage of an operational amplifier.

Statement (II): Differential amplifiers have very high CMRR

Key: (A)

19. Statement (I): Lead compensation is used to improve system stability margins.

Statement (II): Lead compensation achieves the desired result through the merits of its phase lead contribution

Key: (A)

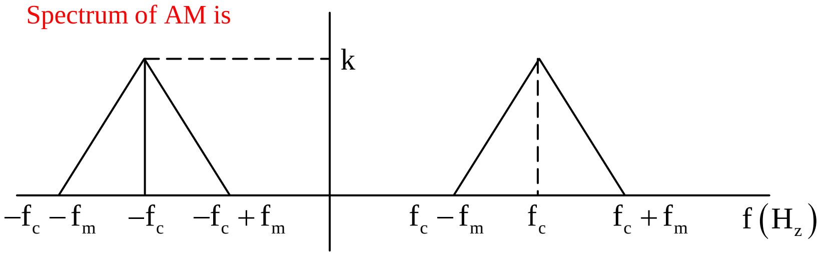
Exp: As initially zero is added the system becomes stable.

20. Statement (I): The bandwidth of AM signal depends on the bandwidth of the modulating signal.

Statement (II): The amplitude-modulated signal contains f_c, $f_c \pm f_m$ frequency signals.

Key: (A)

Exp: Spectrum of AM is



So, bandwidth of AM = 2 f_m
= 2 [modulating signal B.W]

21. When the unit impulse response of a second order system is $\frac{1}{6}e^{-0.8t}\sin 0.6t,$ the natural frequency and damping ratio of the system are respectively

(A) 1 rad/s and 0.8

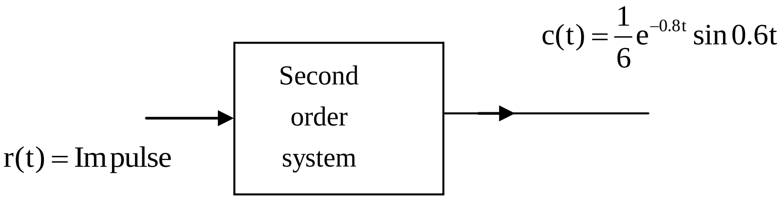
(B) 0.64 rad/s and 0.8

(C) 1 rad/s and 1

(D) 0.64 rad/s and 1

Key: (A)

Exp:



$r(t)=\text{Impulse}$

here $\omega_d=0.6,\ \xi\omega_n=0.8$

$\omega_n\sqrt{1-\xi^2}=0.6;\quad ...(I)$

$\xi\omega_n=0.8\quad ...(II)$

$\frac{I}{II}=\frac{\omega_n\sqrt{1-\xi^2}}{\xi\omega_n}=\frac{0.6}{0.8}$

$0.8\sqrt{1-\xi^2}=0.6\xi$

$\therefore \xi=0.8$

$\&\ \omega_n=\frac{0.8}{\xi}=\frac{0.8}{0.8}=1$

$\omega_n=1r/s$

22. The second-order system defined by $\frac{25}{s^2+5s+25}$ is given a step input. The time taken for the output to settle within $\pm 2\%$ is

(A) 1.2s (B) 2s (C) 1.6s (D) 0.4s

Key: (C)

Exp: $2\%\ t_s=4\tau=\frac{4}{\xi\omega_n}=\frac{4}{5\times\frac{5}{10}}=\frac{40}{25}=1.65$

23. A 4-bit modulo-6 ripple counter uses J-K flip-flops. If the propagation delay of each flip-flop is 50 ns, the maximum clock frequency that can be used is

(A) 5 MHz (B) 6.98 MHz (C) 10 MHz (D) 20 MHz

Key: (A)

Exp: $f_{max}\le\frac{1}{Nt_{pd}}$

$\le\frac{1}{4\times 50\times 10^{-9}}=5MHz$

24. The following switching functions are to be implement using a Decoder

$f_1=\sum m(1,2,4,8,10,14)$

$f_2=\sum m(2,5,9,11)$

$f_3=\sum m(2,4,5,6,7)$

The minimum configuration of the decoder should be

(A) 2 – to - 4 lines (B) 3 – to – 8 lines

(C) 4 – to – 16 lines (D) 5 – to – 32 lines

Key: (C)

Exp: As per the maximum value of min term is 14 so it is required 4 input variables and due to that 16 output lines variable and due to that 16 output lines. So, minimum size will be 4:16 decoder.

25. Transistor is in saturation when

(A) $I_B = I_C$ (B) $I_B > \frac{I_C}{\beta_{dc}}$ (C) $I_B = 0$ (D) $I_B < \frac{I_C}{\beta_{dc}}$

Key: (B)

26. The effects of feedback on stability and sensitivity are

(A) Negative feedback improves stability and system response is less sensitive to external inputs and parameter variations

(B) Feedback does not affect stability but system response is sensitive to disturbances and parameter variations

(C) Feedback does not affect stability and system response is sensitive to disturbances and parameter variations

(D) Negative feedback affects stability and system response is more sensitive disturbances and parameter variations

Key: (A)

27. Which of the following techniques are used to determine relative stability of a closed loop linear system?

1. Bode plot
2. Nyquist plot
3. Nichol's chart
4. Routh-Hurwitz criterion

(A) 1, 2 and 4 only (B) 1, 3 and 4 only (C) 1, 2 and 3 only (C) 1, 2, 3 and 4

Key: (C)

28. A 4-bit D/A converted give an output voltage of 4.5 V for an input code of 1001. The output voltage for an input code of 0110 is

(A) 1.5 V (B) 2.0 V (C) 3.0 V (D) 4.5 V

Key: (C)

Exp: Output = Resolution ×D

Where D= Binary equipment decimal

4.5=Resolution ×9

$\therefore \text{Resolution} = 0.5 \text{ volt}$

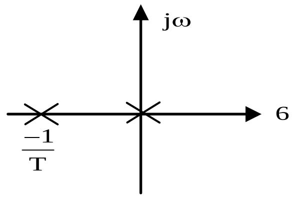
$\text{output} = \text{Resolution} \times D = 0.5 \times 6 = 3.0 \text{ volt}$

29. Given that the transfer function $G(s)=\frac{k}{s^2(1+sT)}$, the type and order of this system are respectively

(A) 5 and 2 (B) 2 and 2 (C) 2 and 3 (C) 3 and 3

Key: (C)

Exp: $G(s)=\frac{k}{s^2(1+sT)}$



Two poles at origion $\Rightarrow$ type − 2system

Total three characteristic equation roots $\Rightarrow$ order − 3 = system

30. The feedback system with characteristic equation

$s^4+20Ks^3+5s^2+10s+15=0$ is

(A) Stable for all values of K

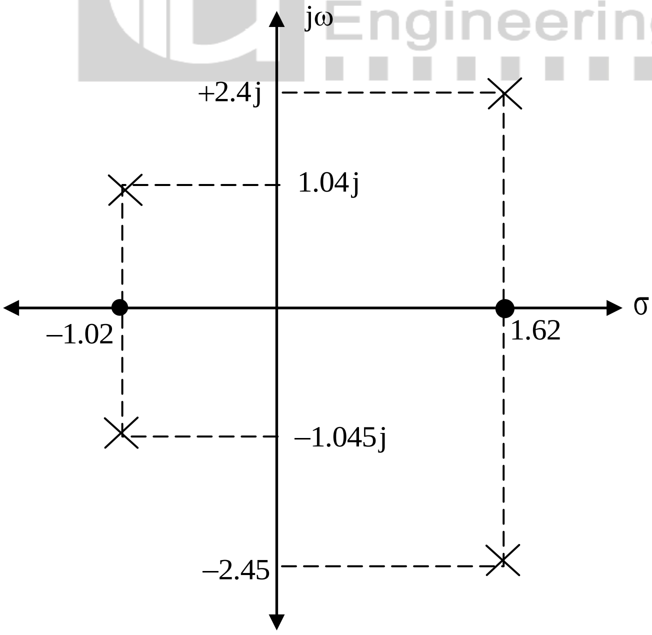
(B) Stable for positive values of K

(C) Stable for 7.0 < K < ∞

(D) Unstable for any value of K

Key: (D)

Exp:



$20ks^3+\left(s^4+5s^2+10s+15\right)=0$

$GH=\frac{20ks^3}{\left(s^4+5s^2+10s+15\right)}$

Z=3; P=4, poles $+1.02\pm 2.44j; -1.02\pm 1.044j$

The system is unstable.

31. The Bode plot of the transfer function G(s) = s is
 1. Constant magnitude
 2. 20 dB/decade
 3. Constant phase shift angle
 4. Constant phase shift of $\pi/2$

 Which of these are correct?

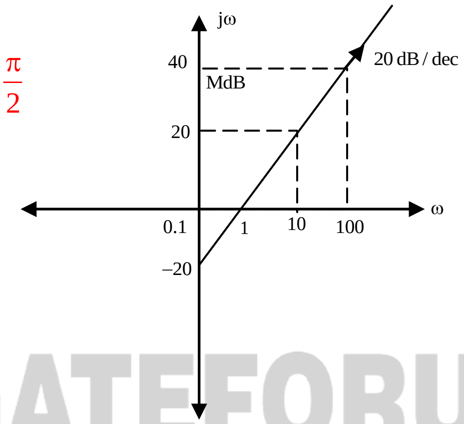
 (A) 1 and 3 (B) 1 and 4 (C) 2 and 3 (D) 2 and 4

Key: (D)

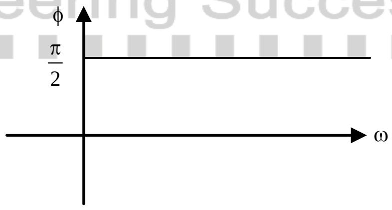
Exp: G(s)=s

$$\text{Mag} = |j\omega| = \omega;\ \phi = \tan^{-1}\left(\frac{\omega}{0}\right) = \frac{\pi}{2}$$

$$M_{dB} = 20\log\omega$$



w	M_{dB}	ϕ
0.1	–20	$\frac{\pi}{2}$
1	0	$\frac{\pi}{2}$
10	20	$\frac{\pi}{2}$
100	40	$\frac{\pi}{2}$



32. The oscillation frequency of the system with the characteristic equation $s^6 + 2s^5 + 3s^4 + 4s^3 + 3s^2 + 2s + 1 = 0$ is

 (A) + 1 radian/sec (B) – 1 radian/sec

 (C) j1 radian/sec (D) – j1 radian/sec

Key: (A)

33. The closed loop transfer function of a unity negative feedback system is $\frac{100}{s^2 + 8s + 100}$. its open loop transfer function is

 (A) $\frac{100}{s+8}$ (B) $\frac{1}{s^2+8s}$ (C) $\frac{100}{s^2-8s}$ (D) $\frac{100}{s^2+8s}$

Key: (D)

Exp:

$$\text{CLTF} = \frac{100}{s^2 + 8s + 100}$$

$$\text{OLTF} = \frac{100}{(s^2 + 8s)}$$

34. The Laplace transform of $e^{-2t}\sin 2\omega t$ is

(A) $\frac{2s}{(s+2)^2+2\omega^2}$ (B) $\frac{2\omega}{(s-2)^2+4\omega^2}$ (C) $\frac{2\omega}{(s+2)^2+4\omega^2}$ (D) $\frac{2s}{(s-2)^2+2\omega^2}$

Key: (C)

35. In a closed loop system for which the output is the speed of a motor, the output rate control can be used to

(A) Limit the speed of the motor

(B) Limit the torque output of the motor

(C) Reduce the damping of the system

(D) Limit the acceleration of the motor

Key: (D)

36. The roots of the characteristic equation $1+G(s)H(s)=0$ are the same as the

(A) Poles of the closed loop transfer function

(B) Poles of the open loop transfer function

(C) Zeros of the closed loop transfer function

(D) Zeros of the open loop transfer function

Key: (A)

37. In a servo-system, the device used for providing derivative feedback is known as

(A) Synchro (B) Servometer (C) Potentiometer (D) Tachogenerator

Key: (D)

38. The transfer function of a controller is $G_C(s)=\frac{1+3s}{1+s}$. The maximum phase control provided by this controller is

(A) 30o lead (B) 30^o lag (C) 45^o lead (D) 45^o lag

Key: (A)

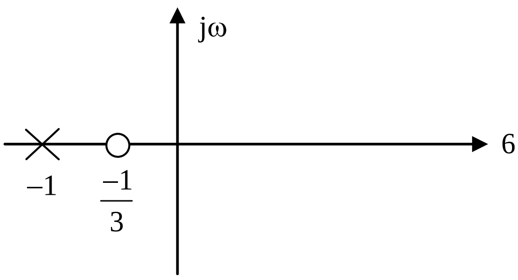
Exp: $G_c(s)=\frac{1+3s}{1+s}$

Lead Compensator;

$\omega_{max}=\sqrt{\frac{1}{3}}$

$\phi_{max}=\sin^{-1}\left(\frac{a-1}{a+1}\right)$; Where a=3,

$\phi_{max}=\sin^{-1}\left(\frac{2}{4}\right)=30^o.$



39. Consider the following statements:

The effect of phase lead network is given as

1. Increased velocity constant.
2. Increased phase margin
3. Increased bandwidth
4. Slower response

Which of the above statements are correct?

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

Key: (C)

40. A binary channel with capacity 63 kbits/s is available for PCM voice transmission. If signal is band limited to 5 kHz, then the appropriate values of quantizing level L and the sampling frequency will be

(A) 64 and 7.2 kHz (B) 32 and 10.5 kHz

(C) 64 and 10.5 kHz (D) 32 AND 7.2 kHz

Key: (C)

Exp: Give capacity of channel = 63 k bits/sec and also f_m = 5kHz

Capacity = nf_s

$f_s > 10$ kHz

Choose from option i.e. 10.5 kHz

So

$$63\text{k bit/sec} = n \times 10.5\text{k}$$

$$n = \frac{63}{10.5} = 6$$

$$\text{so, } L = 2^n = 2^6 = 64$$

41. In order to improve the system response transient behavior, the type of controller used is

(A) Phase lead controller

(B) Phase lag controller

(C) PI controller

(D) P controller

Key: (A)

42. The built-in potential (diffusion potential) in a p-n junction

1. is equal to the difference in the Fermi-level of the two sides, expressed in volts.
2. Increases with the increase in the doping levels of the two sides.
3. Increases with the increase in temperature
4. is equal to the average of the Fermi-levels of the two sides.

Which of the above statements are correct?

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

Key: (A)

Exp: $\psi_o = \frac{E_{fn} - E_{fp}}{q}$

$\psi_o = V_T \ln\left(\frac{V_A N_o}{n_1 2}\right)$

as doping $\uparrow \rightarrow \psi_o \uparrow$

43. Consider the following statements for TEM (Transverse Electro Magnetic) waves:

1. Only for TEM wave, could the conductor separation be small compared with a wavelength.
2. TEM mode needs to be considered at low frequencies.
3. TEM waves are usually not obeying Maxwell's equations
4. TEM waves are usually treated like 'ordinary transmission line signals'.

Which of the above statements are correct?

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

Key: (B)

44. An analog signal is sampled at 36 kHz and quantized into 256 levels. The time duration of a bit of the binary coded signals is

(A) 7.43 μs (B) 6.43 μs (C) 3.47 μs (D) 1.47 μs

Key: (C)

Exp: Given $f_s = 36$ kHz

$L = 256$

So, in PCM $R_b = n \times f_s$

$= 8 \times 36k$

$T_b = \frac{1}{R_b} = 3.472\,\mu\text{sec}$

45. The ratio $\frac{\sigma}{\omega\varepsilon}$ is

1. Intrinsic ratio
2. Loss tangent
3. Conduction ratio
4. Dissipation factor

Which of these are correct?

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

Key: (D)

Exp: Loss Tangent $\tan\delta = \frac{\sigma}{w \in}$

Dissipation factor and loss tangent are effectively same

46. A transmitting antenna with a 300 MHz carrier frequency produces 2 kW of power. If both transmitting and receiving antennas have unity power gain, the power received by the receiving antenna at a distance of 1 km is

(A) 11.8 mW (B) 18.4 mW (C) 18.4 μW (d) 12.7 μW

Key: (D)

Exp:
$$P_r = P_t.G_t.G_r\left[\frac{\lambda}{4\pi r}\right]^2$$
$$\lambda = \frac{3\times10^8}{3\times10^8} = 1m$$
$$r = 1km$$
$$G_t = G_r = 1$$
$$So, P_r = 2k.\left[\frac{1}{4\pi\times10^3}\right]^2$$
$$= \frac{2\times10^3}{4\pi\times4\pi\times10^6} = \frac{1}{8\pi^2}\times10^{-3}$$
$$\approx \frac{1}{8}\times10^{-4}$$
$$\approx 12.5\mu\,Watts$$

47. If the diameter of a $\frac{\lambda}{2}$ dipole antenna is increased from $\frac{\lambda}{100}$ to $\frac{\lambda}{50}$ then its

(A) Bandwidth increases
(B) Bandwidth decreases
(C) Gain increases
(D) Gain decreases

Key: (C)

Exp:
$$A_e = \frac{\lambda^2}{4\pi}.G_d$$
$$G_d = \left(\frac{4\pi}{\lambda^2}\right).\frac{\pi D^2}{4} \quad \left[\text{where D is a diameter of Antenna}\right]$$
$$G_d = \pi^2\left(\frac{D}{\lambda}\right)^2$$
$$G_d \alpha \left(\frac{D}{\lambda}\right)^2$$

Where ever diameter increases, gain of Antenna increases.

48. The ideal gain of a parabolic antenna of diameter 10 m for a wavelength of 316 cm is

(A) 20 dB (B) 30 dB
(C) 40 dB (D) 60 dB

Key: (D)

Exp: $G_A = \pi^2\left(\frac{D}{\lambda}\right)^2$

$$= \pi^2.\left(\frac{10}{3.16}\right)^2$$

$$= 98.8 = 100$$

$$\text{gain dB is } G_A = 10\log 10^2$$

$$= 20\text{dB}$$

49. An antenna consists of 4 identical Hertzian dipoles uniformly located along the z-axis and polarized in z-direction. The spacing between the dipoles is $\frac{\lambda}{4}$. The group pattern function is

(A) $4\cos\left(\frac{\pi}{4}\cos\theta\right)\cos\left(\frac{\pi}{2}\cos\theta\right)$ (B) $4\cos\left(\frac{\pi}{4}\cos\theta\right)\cos\left(\frac{\pi}{8}\cos\theta\right)$

(C) $4\cos\left(\frac{\pi}{4}\cos\theta\right)\sin\left(\frac{\pi}{2}\cos\theta\right)$ (D) $4\cos\left(\frac{\pi}{4}\cos\theta\right)\sin\left(\frac{\pi}{8}\cos\theta\right)$

Key: **(A)**

Exp: Group pattern functions is defined as

$$F(\theta) = \frac{\sin\frac{N\psi}{2}}{\sin\frac{\psi}{2}}, \text{here } N = 4$$

$$\text{where } \psi = \beta d\cos\theta + \alpha$$

$$\psi = \frac{2\pi}{\lambda}.\frac{\lambda}{4}\cos\theta$$

$$= \frac{\pi}{2}\cos\theta$$

$$F(\theta) = \frac{\sin 2\psi}{\sin\frac{\psi}{2}} = \frac{2\sin\psi.\cos\psi}{\sin\frac{\psi}{2}}$$

$$F(\theta) = \frac{4\cos\frac{\psi}{2}.\sin\frac{\psi}{2}.\cos\psi}{\sin\frac{\psi}{2}}$$

$$\text{so, } F(\theta) = 4\cos\frac{\psi}{2}.\cos\psi$$

$$= 4\cos\left(\frac{\pi}{4}\cos\theta\right).\cos\left(\frac{\pi}{2}\cos\theta\right)$$

50. Current required to radiate 100 W of power at 100 MHz from 0.01 m dipole will be

(A) 131 A (B) 141 A (C) 151 A (D) 161 A

Key: **(C)**

Exp: $P_{rad} = \frac{I_0^2}{2} R_{rad}$

So, R_{rad} for Herzian dipole because

$l = 0.01m$

$$dl \simeq \frac{\lambda}{300}$$

$$R_{rad} = 80\pi^2 \left(\frac{dl}{\lambda}\right)^2$$

$$= 80\pi^2 \left(\frac{1}{300}\right)^2 = 8.77 \times 10^{-3}\Omega$$

$$I_0 = \sqrt{22,797.2} = 150.9.8 = 151A$$

51. The length of half-wave dipole at 30 MHz will be

(A) 5 m (B) 10 m (C) 15 m (D) 5.5 m

Key: (A)

Exp: $l = \frac{\lambda}{2}$ for half-wave dipole

So, $\lambda = \frac{c}{f} = \frac{3\times10^8}{3\times10^7} = 10m$

$l = 3m$

52. Microwave impedance measurement is carried out by

(A) Slotted line method, Reactive discontinuity and Reflectometer

(B) Wave meter method, Slotted line method and Down conversion method

(C) Slotted line method, CW measurement and swept frequency measurement

(D) None of the above

Key: (A)

Exp: For Impedance measurement is carried out by slotted line and Relfectometer (using probe method)

53. A modulated signals is given by

$$s(t) = e^{-at}\cos\left[(\omega_c + \Delta\omega)t\right]u(t)$$

The complex envelop of s(t) is

(A) $e^{-at}e^{\left[j(\omega_c+\Delta\omega)t\right]}u(t)$ (B) $e^{-at}e^{\left[j\Delta\omega t\right]}u(t)$

(C) $e^{\left[j\Delta\omega t\right]}u(t)$ (D) $e^{\left[j(\omega_c+\Delta\omega)t\right]}u(t)$

Where, a, ω_c and $\Delta\omega$ are positive constants and $\omega_c >> \Delta\omega$.

Key: (B)

Exp: Given modulated signal is

$$S(t) = e^{-at}\cos\left[(\omega_c + \Delta\omega)t\right]u(t)$$

$$\text{so} \quad s(t) = \text{Real}\left\{e^{-at}e^{j\omega_c t}e^{j\beta\omega t}\right\}u(t)$$

$$s(t) = \text{Real part of}\left[e^{-at}\, e^{j\Delta\omega t}\, e^{j\omega_c t}\right]u(t)$$
$$= \text{Real part of}\left[\tilde{S}(t)e^{j\omega_c t}\right]$$
$$\tilde{S}(t) = \text{complex envelope of } s(t)$$
$$= e^{-at}e^{j\Delta\omega t}u(t)$$

54. The frequency range for satellite communication is

(A) 1 kHz – 100 kHz
(B) 100 kHz – 1 MHz
(C) 10 MHz – 30 MHz
(D) 1 GHz – 30 GHz

Key: (D)

Exp: The frequencies ranges of satellites are 3 to 30 GHz with a band width about 500 MHz.

55. A parabolic dish antenna of 1 m diameter and efficiency of 70%, operating at 20 GHz, will have a gain of nearly

(A) 20 dB (B) 25 dB (C) 30 dB (D) 40 dB

Key: (D)

Exp:
$$G_A = \pi^2\left(\frac{D}{\lambda}\right)^2 \times 0.7$$
$$\simeq 7\left(\frac{D}{\lambda}\right)^2$$

Here $D = 1m$

$$f = 20\,GHz; = \lambda = \frac{3\times10^8}{2\times10^{10}} = 1.5\times10^{-2}$$
$$G_A \simeq 7\left(\frac{1}{1.5\times10^{-2}}\right)^2$$
$$\simeq 31.1\times10^3 \simeq 44.9\,dB$$

56. The decimal equivalent of Binary 110.001 is

(A) 6.25 (B) 6.125 (C) 62.5 (D) 0.612

Key: (B)

57. Given $(125)_R = (203)_5$. The value of radix R will be

(A) 16 (B) 10 (C) 8 (D) 6

Key: (D)

Exp: $(125)_R = (203)_5$

$$1\times R^2 + 2\times R + 5\times R^0 = 2\times5^2 + 0\times5' + 3\times5^o$$
$$R^2 + 2R + 5 = 53$$
$$R^2 + 2R - 48 = 0$$
$$R^2 + 8R - 6R - 48 = 0$$

$R(R+8)-6(R+8)=0$

$(R-6)(R+8)=0$

$R=6, R\neq -8$

58. The 9's complement of $(25.639)_{10}$ is

(A) 74.360 (B) 0.6732 (C) 6.732 (D) 7.436

Key: (A)

Exp: 9's complement:

$$\begin{array}{r} 99.999 \\ -25.639 \\ \hline 74.360 \\ \hline \end{array}$$

59. Consider the following statements:

1. When two unsigned numbers are added, an overflow is detected from the carry into the most significant position.
2. An overflow does not occur if the two numbers added are both negative.
3. If the carry into the sign bit position and carry out of the sign bit position are not equal, an overflow condition is produced.

Which of the above statements is/are correct?

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

Key: (D)

60. The statement label in a subroutine

(A) May be the same as in the main program
(B) Is always the same as in the main program
(C) Cannot be the same as in the main program
(D) Cannot be used

Key: (A)

61. A transistor uses potential divider method of biasing. $R_1=50\,k\Omega$, $R_2=10\,k\Omega$ And $R_E=1\,k\Omega$. If $V_{CC}=12V$ and $V_{BE}=0.1V$, then I_C is

(A) 19 mA (B) 2 mA (C) 1.9 mA (D) 0.19 mA

Key: (C)

$$V_{th}=12\times\frac{10}{60}=2V$$

$$R_{th}=101/50=\frac{500}{60}=\frac{50}{6}k\Omega$$

No β available $\left(\text{Ideal } \beta=\infty\right)$

Hence Assume $I_8=0$

$$I_C=I_E=\frac{2-0.1}{1k\Omega}=1.9\,mA$$

62. Consider the following statements in the context of the conditions needed to operate a Bipolar Junction Transistor (BJT) in active region in a linear circuit:

1. The emitter diode must be forward biased.
2. The collector diode must be reverse baised
3. The voltage across the collector diode must be greater than the breakdown voltage.
4. The voltage across the collector diode must be less than the breakdown voltage.

Which of the above statements are correct?

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

Key: (C)

63. An FET-input IC operational amplifier has an open loop differential gain of 1, 00,000 and a common mode gain of 25. Then the common mode rejection ratio is

(A) 46 dB (B) 72 dB (C) 106 dB (D) 144 dB

Key: (B)

$A_{DM} = 10^5$

$A_{CM} = 25$

$$CMRR = \frac{A_{DM}}{A_{CM}} = \frac{10^5}{25}$$

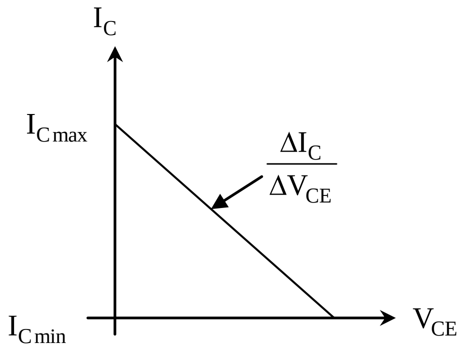
$$CMRR(dB) = 20\log\left(\frac{10^5}{25}\right) = 72\text{ dB}$$

64. In biasing of BJT, the slop of load line can be calculated using

(A) Operating base current
(B) Operating collector current
(C) Operating point co-ordinates
(D) Minimum and maximum values of collector current

Key: (D)

Exp:



65. Leakage current approximately doubles for every 10^oC increase in temperature of a silicon transistor. If a silicon transistor has $I_{CBO} = 1000\,nA$ at 30^oC, what is its leakage current at 90^oC?

(A) 32μA (B) 64 μA (C) 16 μA (C) 128 μA

Key: (B)

66. Which of the following statements are correct?

1. ICO for germanium is much greater than silicon
2. The steady-state temperature rise at the collector junction is proportional to the power dissipated at the junction
3. To avoid thermal runaway the required condition is that the rate at which heat is released at the collector junction must exceed the rate at which the heat can be dissipated under steady-state conditions.

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

Key: ( )

67. Upper 3 dB cut-off of common emitter amplifier depends on

(A) E-B junction capacitance (B) C-B junction capacitance

(C) Capacitance of both junctions (D) Coupling capacitor capacitance

Key: (C)

68. Consider the following statements in respect of an R-C coupled transistor amplifier:

1. The low frequency response is determined by the transistor junction capacitors.
2. The high frequency response is limited by coupling capacitors.
3. The miller capacitance reduces the gain at high frequencies.
4. As the gain is increased the bandwidth gets reduced.

Which of the above statements are correct?

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

Key: (C)

69. The transfer function of any stable system which has no zeros or poles in the right half of the s-plane is said to be

(A) Minimum phase transfer function (B) Non-minimum phase transfer function

(C) Minimum frequency response function (D) Minimum gain transfer function

Key: (A)

70. The h-parameters of a CE amplifier feeding a load of $10\,k\Omega$ are $h_{ie} = 1k\Omega$, $h_{fe} = 50$, $h_{re} = 0$, and $1/h_{oe} = 40\,k\Omega$. The voltage gain would be

(A) – 40 (B) – 100 (C) – 400 (D) – 500

Key: (C)

$$R'_L = 10k\Omega \| 40k\Omega$$

$$i_b = \frac{V_i}{1k\Omega}$$

$$V_o = -50 i_b \left(10k\Omega \| 40k\Omega\right)$$

$$V_o = \frac{50V_i}{1k\Omega}\frac{10\times 40}{50}k\Omega$$

$$A_V = -400$$

71. Which of the following is the principal factor that contributes to the doubling of the conversion efficiency in a transformer coupled amplifier?

(A) Reducing the power dissipated in the transistor

(B) Eliminating the power dissipation in the transformer

(C) Elimination of dc power dissipated in the load

(D) Impedance matching of the transformer

Key: (D)

72. A power amplifier operated from 12 V battery gives an output of 2W. The maximum collector current in the circuit is

(A) 166.7 μA (B) 166.7 mA (C) 166.7 A (D) 16.67 mA

Key: (B)

$V_{CC}I_{CQ} = P_{max}$

$12 \times I_{CQ} = 2W$

$I_{CQ} = 166.7 \text{ mA}$

73. The selectivity of turned radio frequency (TRF) receiver is poor because

1. Q-factor requirement of tuned circuits in RF amplifier is not fixed.
2. Q required for upper side of short wave is 2000.
3. Q-factor is zero

Which of the above statements are correct?

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

Key: (B)

74. Consider the following statements pertaining to frequency response of RC coupled amplifier.

1. Coupling capacitance affects high frequency response
2. Bypass capacitance affects high frequency response
3. Coupling capacitance affects low frequency response.
4. Bypass capacitance affects low frequency response.

Which of the above statements are correct?

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

Key: (B)

75. An operational amplifier possesses

(A) Very large input resistance and very large output resistance

(B) Very large input resistance and very small output resistance

(C) Very small input resistance and very small output resistance

(D) Very small input resistance and very large output resistance

Key: (B)

76. A power supply uses bridge rectifier with capacitor input filter. If one of the diodes is defective, then

1. The dc load voltage will be lower than its expected value.
2. Ripple frequency will be lower than its expected value.
3. The surge current will increase manifold

Which of the above statements are correct?

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

Key: (D)

77. In an L-section filter, a bleeder resistance is connected across the load to

(A) Provide good regulation for all values of load

(B) Ensure lower PIV of the diodes

(C) Ensure lower values of capacitance in the filter

(D) Reduce ripple content

Key: (A)

78. A full wave rectifier uses 2 diodes. The internal resistance of each diode is 20Ω. The transformer RMS secondary voltage from centre tap to each end of secondary is 50 V and the load resistance is $980\,\Omega$. Mean load current will be

(A) 45A (B) 4.5A (C) 45mA (D) 45 μA

Key: (C)

Main load current

$$I_{avg} = \frac{2I_m}{\pi}$$

$$= \frac{2}{\pi}\left(\frac{50\times\sqrt{2}}{980+20}\right)$$

$$= \frac{2}{\pi}\left(\frac{50\sqrt{2}}{1000}\right)$$

$$= 45\text{ mA}$$

79. In a voltage regulator, zener diode is

1. Connected in series with filter output
2. Forward biased
3. Connected in parallel with filter output
4. Reverse biased

Which of the above are correct?

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

Key: (B)

80. For an OP-Amp pahse shift oscillation, the frequency of oscillations is

(A) $\frac{1}{2\pi RC}$ (B) $\frac{1}{2\pi R^2C^2}$ (C) $\frac{1}{2\pi RC\sqrt{6}}$ (D) $\frac{1}{2\pi RC\sqrt{6}}$

Key: (C)

81. Which of the following statements are correct for Bode plots?

1. Gain margin and phase margin can be easily determined.
2. Absolute and relative stability of only minimum-phase systems can be determined.
3. Gain margin is positive and system is stable, if magnitude of $L(j\omega)$ at phase crossover is positive.

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

Key: (C)

82. A communication channel disturbed by Gaussian noise has a bandwidth of 6 kHz and S/N ratio of 15. The maximum transmission rate that such a channel can support is

(A) 2.4 k bits/sec (B) 24 k bits/sec (C) 32 k bits/sec (D) 48 k bits/sec

Key: (B)

Exp: Capacity of channel $= B\log_2\left(1+\frac{S}{N}\right)$ bit/sec

$\simeq 6k\log_2(16)$

$= 24\,k\,bit/sec$

83. For an AM signal, the bandwidth is 20 kHz and the highest frequency component present is 800 kHz. The carrier frequency used for this AM signal is

(A) 710 kHz (B) 705 kHz (C) 700 kHz (D) 790 kHz

Key: (D)

Exp: Given AM_a bandwidth = 20 kHz

$2f_m = 20$ kHz

$f_m = 10$ kHz

and also given $f_c + f_m = 800$ kHz

$f_c = 790$ kHz

84. The aerial current of an AM transmitter is 18A when un-modulated, but increases to 20 A when modulated. The modulation index is

(A) 0.68 (B) 0.73 (C) 0.89 (D) 0.98

Key: (A)

Exp: $I_t = 20A$

$I_c = 18$ (when unmodulated)

So, in AM relation between I_t and I_c is

$$I_t = I_c\sqrt{\left[1+\frac{m^2}{2}\right]}$$

$$\text{So, } \left(\left(\frac{I_t}{I_c}\right)^2 - 1\right)2 = m^2$$

So, m = 0.68

85. A carrier wave is phase modulated with frequency deviation of 20 kHz by a single tone frequency of 2 kHz. If the single tone frequency is increased to 2 kHz, assuming that phase deviation remains unchanged, bandwidth of the PM signal is

(A) 20 kHz (b) 32 kHz (C) 22 kHz (D) 44 kHz

Key: (D)

Exp: In phase modulation

$$k_\rho A_m = \Delta\phi = \beta = \frac{\Delta f}{f_m}$$

$$\text{So}, \beta = 10$$

$$\text{B.W in FM is} = 2(\beta+1)f_m$$

$$= 22 \times 2\,\text{kHz}$$

$$= 44\,\text{kHz}$$

Case (i)

When frequency increase by 2kHz

$$\beta = 5$$

$$\text{B.W} = 2(\beta+1)\times 4 = 48\,\text{kHz}$$

Case (ii)

When frequency increased to 2kHz

$$\text{B.W} = 2(10+1)\times 2\,\text{kHz}$$

$$= 44\,\text{kHz}$$

86. A sinusoidal audio signal is given by $e_s = 15\sin 2\pi(2000t)$. It modulates a sinusoidal carrier wave $e_c = 60\sin 2\pi(10^5 t)$. The value of amplitude modulation index must be

(A) 0.5 (B) 4 (C) 0.6 (D) 0.25

Key: (D)

Exp: $\text{Modulation Index} = \frac{A_m}{A_c} = \frac{15}{60} = 0.25$

87. A half duty cycle rectangular clock output is sampled at 5 times its rate. Spectrum of the sampled clock will be having mirror image in negative frequency domain of a

(A) Sampled sinc pulse (B) Periodic sinc pulse

(C) Periodic sampled sinc pulse (D) None of the above

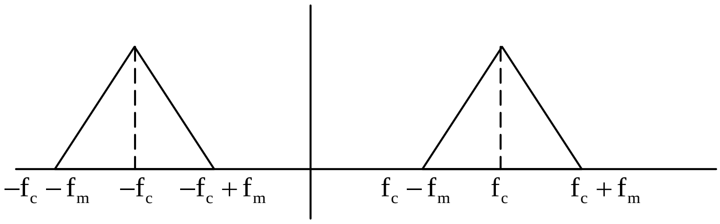
Key: (C)

88. A signal of maximum frequency of 2 MHz modulated by 4GHz is DSB/SC. If the resultant signal is sampled ideally as low pass signal, the minimum sampling frequency should be

(A) 4 Mhz (B) 8 MHz (C) 4.004 GHz (D) 8.008 GHz

Key: (A)

Exp: DSB-SC spectrum is



If the spectrum is sampled (which is band pass signal)

$f_c + f_m = 4.002$ GHz

$$\text{Sampling frequency} \geq \frac{2(f_c + f_m)}{n}$$

$$\text{where } n \leq \frac{f_c + f_m}{B.W}$$

$$n \leq \frac{4.002G}{4M} = 1000.5$$

$$n = 1000$$

$$\text{so, } f_s \geq \frac{2 \times 4.002G}{1000}$$

$$f_s \geq 8.004\text{MHz}$$

Minimum sampling frequency 8.004 MHz.

89. If n_1 and n_2 are the refractive indicates of the core and cladding respectively, the maximum acceptance angle at the air-core interface should

(A) $\tan^{-1}\frac{n_2}{n_1}$ (B) $\sin^{-1}\sqrt{n_2^2 - n_1^2}$ (C) $\sin^{-1}\sqrt{n_1^2 - n_2^2}$ (D) $\tan^{-1}\frac{n_1}{n_2}$

Key: (C)

Exp: $\sin\theta_A = NA = n_1 \sin\theta_c = \sqrt{n_1^2 - n_2^2}$

$$\theta_A = \sin^{-1}\sqrt{n_1^2 - n_2^2}\,(n_1 > n_2)$$

90. Which of the following statements regarding binary counter are correct?

1. Clock inputs of all the flip-flops of a synchronous counter are applied from the same source whereas those in an asynchronous counter are from different sources
2. Asynchronous counter has ripple effects whereas synchronous counter has not.
3. Only J-K flip-flops can be used in synchronous counter whereas asynchronous counter can be designed with any type of flip-flops.

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

Key: (D)

91. Maximum frequency reflected from ionosphere is 9 MHz on a particular day. The maximum ion density/metere^3 is

(A) 10^8 (B) 10^6 (C) 10^{12} (D) 10^9

Key: (C)

Exp:
$$f_c = 9\sqrt{N_{max}}$$
$$N_{max} = \frac{81\times10^{12}}{9}$$
$$= 9\times10^{12}$$

92. The anti-aliasing filter has a higher cut-off frequency f_m. Its output is sampled periodically every TS seconds. For proper recovery of the signal at the receiver, T_S must be

(A) $T_S \ge \frac{1}{(2f_m)}$ (B) $T_S \le \frac{2}{(2f_m)}$ (C) $T_S \ge \frac{2}{f_m}$ (D) $T_S \le \frac{2}{f_m}$

Key: (B)

Exp: To avoid aliasing
$$f_s \ge 2f_m$$
$$\frac{1}{T_s} \ge 2f_m$$
$$T_s \le \frac{1}{2f_m}$$

93. A binary channel with capacity 36 k bits/s is available for PCM voice transmission. If signal is band limited to 3.2 kHz, then the appropriate values of quantizing level L and sampling frequency will be

(A) 64 and 7.2 kHz (B) 32 and 7.2 kHz (C) 64 and 3.6 kHz (D) 32 and 3.6 kHz

Key: (B)

Exp: Given B.W of signal = 3.2 kHz

Capacity of channel = 36 kb lt/sec

So, $f_s \ge 6.4\,kHz$

From options choose f_s = 7.2 kHz

So, C = nf_s,
$$n = \frac{36}{7.2} = 5$$
$$\text{so}, L = 2^n = 32$$

94. A fibre-optic cable has the indices of refraction of core of 1.6 and of cladding of 1.4. For an angle of incident 70^o, the angle of return light ray will be

(A) 35^o (B) 61^o (C) 70^o (D) 90^o

Key: (C)

Exp: From snells law
$$\theta_i = \theta_r$$

95. In an optical communication system, having an operating wavelength λ in metres, only X% of its source frequency can be used as its channel bandwidth. The system is to be used for transmitting TV signal requiring a bandwidth of f Hz. The number of channels transmitted by this system simultaneously is (c = speed of light)

(A) $\frac{100\text{ X c}}{\lambda f}$ (B) $\frac{100\lambda f}{\text{X c}}$ (C) $\frac{\text{X c}}{\lambda f}$ (D) $\frac{\text{X c}}{100\lambda f}$

Key: (D)

Exp: Given channel bandwidth $= x\% \times \text{frequency}$

$$= \frac{x}{100}.\frac{c}{\lambda}$$

$$= \frac{x_c}{100\lambda}$$

T.V signal bandwidth = f Hz

So, number of channels transmitted by this system $= \frac{\text{channel B.W}}{\text{signal B.W}}$

$$= \frac{x.c}{100\lambda.f}$$

96. An optical fibre communication system works on a wavelength of 1.3 μm. The number of subscribers it can feed, if a channel requires 20 kHz, is

(A) 2.3×10^{10} (B) 1×10^{5} (C) 1.15×10^{10} (D) 10^{10}

Key: (C)

Exp: $k = \text{no. of channels require} = \frac{\lambda}{1.3\mu m}$

$$\lambda = \frac{3\times10^8}{20\times10^3} = 1.5\times10^4$$

$$\text{So, } k = \frac{1.5\times10^4}{1.3\times10^{-6}}$$

$$= 1.15\times10^{10}$$

97. Consider the following statements regarding a common emitter amplifier. It can be converted into an oscillator by

1. Providing adequate positive feedback
2. Phase shifting the output by 180^0 and feeding this phase-shifted output to the input.
3. Using only a series turned circuit as a load on the amplifier.
4. Using the negative resistance device as a load on the amplifier.

Which of the above statements are correct?

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

Key: (B)

98. For an angle modulated signal,

$$x(t) = 6\cos\left[2\pi\times10^6 t + 2\sin(8000\text{rt}) + 4\cos(8000\,\text{rt})\right]\text{V}.$$

The average power of x(t) is

(A) 10 W (B) 18 W (C) 20W (D) 28 W

Key: (B)

Exp: Average power of $x(t) = \frac{A_c^2}{2} = \frac{36}{2} = 18\,\text{W}$

99. A single tone 4 kHz message signal is sampled with 10 kHz and 6 kHz. Aliasing effect will be seen in the reconstructed signal when the signal is sampled with

(A) 10 kHz (B) 6 kHz

(C) Both 10 kHz and 6 kHz (D) Neither 10 kHz nor 6 kHz

Key: (B)

Exp: i.e., $f_s > 2fm$, this car no aliasing occur by nyquiste rate, $f_s > 8$kHz,
If $f_s < 8$kHz, aliasing occur.

100. A source produces 26 symbols with equal probabilities. What is the average information produced by the source?

(A) Less than 4 bits/symbol

(B) 6 bits/symbol

(C) 7 bits/symbol

(D) Between 4 bits/symbol and 6 bits/symbol

Key: (D)

Exp: $H(x) = \log_2 m$ (source have equal probabilities)
$= \log_2 26$
$= 4.57$ bits/symbol

101. Consider the following statements:

A Schottky diode is included when a transistor is fabricated so as to

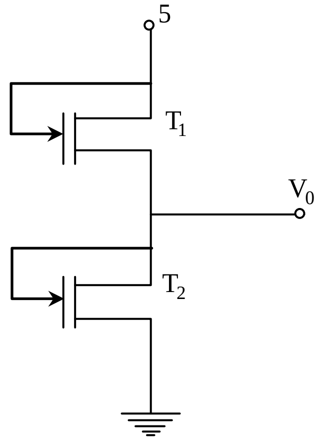
1. Prevent the transistor from full saturation.
2. Eliminate saturation delay time
3. Achieve better switching speed
4. Reduce thermal stability.

Which of the above statements are correct?

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

Key: (B)

102. The transmission T_1 and T_2 shown in the figure have a threshold voltage of 1 volt. The device parameters K_1 and K_2 of T_1 and T_2 are $36\,\mu A/V^2$ and $9\,\mu A/V^2$ respectively. The output voltage V_o is nearly



(A) 1V (B) 2V (C) 3V (D) 4V

Key: (C)

Both T_1 & T_2 are in saturation.

$$I_{D_1} = I_{D_2}$$

$$36(5-V_o-1)^2 = 9(V_o-1)^2$$

$$2(5-V_o-1) = V_o-1$$

$$8-2V_o = V_o-1 \Rightarrow 3V_o = 9 \Rightarrow V_o = 3V$$

103. On simplification of expression

$Y = \overline{(A\bullet B+\bar{C})(\overline{A+B}+C)}$, using Boolean algebra, the solution is

(A) $(A\bullet B+C)(A+B\bullet C)$

(B) $(\bar{A}+\bar{B}+\bar{C})(A+B+C)$

(C) $(A\bullet B+\bar{C})(A\bullet C+\bar{B})$

(D) $(B\bullet C+\bar{A})(A\bullet B+\bar{C})$

Key: (B)

Exp:

$$=\overline{(AB+\bar{C})(\bar{A}\bar{B}+C)}$$

$$=\overline{(\bar{C}+AB)(C+\bar{A}\bar{B})}$$

$$=\overline{ABC+\bar{A}\bar{B}\bar{C}}$$

$$=(\bar{A}+\bar{B}+\bar{C})(A+B+C)$$

Property to be used

$$(A+B)(\bar{A}+C) = \bar{A}B + AC$$

104. The large signal bandwidth of an operational amplifier is limited by its

(A) CMRR (B) Slew rate

(C) Gain-bandwidth product (D) Input impedance

Key: (B)

105. The minimum number of gates required to realize the function $AB+\bar{C}$ (using NAND gates only) is

(A) 2 (B) 3 (C) 4 (D) 6

Key: (A)

Exp: $Y=\overline{\left(\overline{AB}\right).C}$

$=AB+\bar{C}$

106. What is the correct sequence when the logic families TTL, ECL, IIL and CMOS are arranged in descending order of fan-out capabilities?

(A) CMOOS, TTL, ECL and IIL
(B) IIL, TTL, ECL and CMOS
(C) IIL, ECL, TTL and CMOS
(D) CMOS, ECL, TTL and IIL

Key: (D)

107. K-map method of simplification can be applied when the given function is in

(A) Product of sum form
(B) Sum of product form
(C) Canonical form
(D) any form

Key: (C)

108. If the inverting input terminal of an operational amplifier is grounded and a sinusoidal voltage wave form is applied at the non-inverting input terminal, the output will be

(A) Square wave
(B) Triangular wave
(C) Half wave rectified sine wave
(D) Full wave rectified sine wave

Key: (A)

109. The function $Y=A+\bar{B}\bullet C$ in canonical sum of product form is

(A) $Y=\Sigma 1,3,5,6,7$
(B) $Y=\Sigma 1,4,5,6,7$
(C) $Y=\Sigma 2,3,5,6$
(D) $Y=\Sigma 2,3,5,7$

Key: (B)

Exp: $Y=A\left(B+\bar{B}\right)(C+\bar{C})+)(A+\bar{A}).\bar{B}C$

$=\sum m(1,4,5,6,7)$

110. The correct instruction execution sequence is

(A) Execute, Decode and Fetch
(B) Fetch, Execute and Decode
(C) Execute, Fetch and Decode
(D) Fetch, Decode and Execute

Key: (D)

111. A half adder can be constructed using

(A) One XOR and one OR gate with their outputs connected in parallel
(B) One XOR and one OR gate with their outputs connected in series
(C) One XOR gate and one AND gate
(D) Two XNOR gages only

Key: (C)

112. For an SR flip-flop, S and R are made equal to

1. What is the value of Q?

(A) Unchanged (B) Clear to 0 (C) Set to 1 (D) Indeterminate

Key: (D)

113. Which of the following statements are correct?

1. A magnitude comparator is a sequential circuit that compares 2 numbers.
2. A decoder with enable input can function as a demultiplexer.
3. The number of AND gates in a 32-to-1 line multiplexer is 32.
4. The number of 3 × 8 decoders required to realizes a 6 × 64 decoder is 8.

(A) 2, 3 and 4 only (B) 1, 2 and 4 only

(C) 1, 3 and 4 only (D) 1, 2, 3 and 4

Key: (A*) 4 th statement is wrong

114. The number of branches of the root loci of the equation $s(s+4)(s+5)+K(s+2)=0$ is

(A) 2 (B) 3 (C) 4 (D) 5

When K varies from $-\infty$ to $+\infty$.

Key: (B)

Exp: $1+\frac{k(s+2)}{s(s+4)(s+5)}=0;$

$$GH=\frac{k(s+2)}{s(s+4)(s+5)}$$

$P=3$

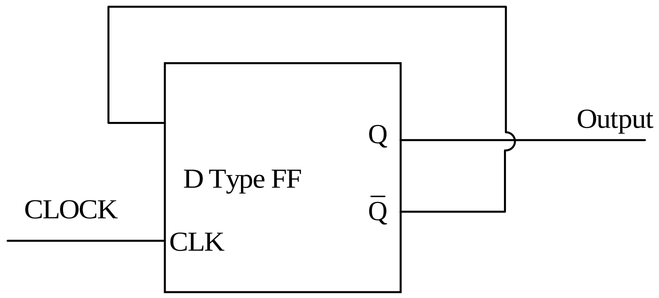
$z=1$

Root Loci branches = Max (P,z)

$=\text{Max}(3,1)$

$=3$

115. What is the frequency of the output Q for the circuit shown in the figure?



(A) Twice the input clock frequency

(B) Half the input clock frequency

(C) Same as the input clock frequency

(D) Inverse of the propagation delay of the flip-flop

Key: (B)

116. Four memory chips of 16 × 4 sizes have their address buses connected together. This system will be of size

(A) 64 × 4 (B) 32 × 8 (C) 16 × 16 (D) 256 × 1

Key: (C)

117. The time required for the step response to decrease and stay within a specified percentage of its final value is called

(A) Delay time (B) Rise time (C) Lag time (D) Setting time

Key: (D)

118. A converted type 8-bit A/D converter is driven by a 500 kHz clock. What are the maximum counts, average conversion time and maximum conversion rate respectively?

(A) 256 counts, 200×10^{-6} sec and 1000 conversion/sec

(B) 256 counts, 256×10^{-6} sec and 1953 conversions/sec

(C) 128 counts, 256×10^{-6} sec and 1200 conversion/sec

(D) 128 counts, 200×10^{-6} sec and 1000 conversion/sec

Key: (B)

119. The speed of conversion is maximum in

(A) Successive approximation A/D converter

(B) Parallel comparative A/D converter

(C) Counter ramp A/D converter

(D) Dual slope A/D converter

Key: (D)

120. In an 8-bit D/A converter, the reference voltage used is 10V. What voltage is represented by 1010 0001?

(A) 0.00392V (B) 6.314V (C) 6.288 V (D) 5.814 V

Key: (B)