ESE- 2020 (Prelims) - Offline Test Series Test- 7

ELECTRONICS & TELECOMMUNICATION ENGINEERING

SUBJECT: ELECTRONIC MEASUREMENTS & INSTRUMENTATION, BASIC ELECTRONICS ENGINEERING AND ANALOG & DIGITAL COMMUNICATION SYSTEMS - SOLUTIONS

01. Ans: (d)

Sol: $f_{m1} = 2\text{kHz}$ $f_{m2} = 3\text{kHz}$

$f_c + 5\text{kHz} = f_c + f_{m1} + f_{m2}$

$$S(t) = A_c \sum_{m=-\infty}^{\infty} \sum_{n=-\infty}^{\infty} J_m(\beta_1)_{m=1} J_n(\beta_2)_{n=1} \cos 2\pi(f_c + mf_1 + nf_2 t)$$

Bessel function coefficient = $A_c J_1(\beta_1) J_1(\beta_2)$

02. Ans: (c)

Sol: According to carson's rule the number of side bands having significant magnitude is $\beta + 1$. So 6 upper and 6 lower side bands are having significant magnitude and the power is 99% of the total power. So answer is $f_c - 6f_m$ to $f_c + 6f_m$.

03. Ans: (d)

Sol: $A_c(1+\mu) = 12$ ___(1)

$A_c(1-\mu) = 4$ ____(2),

where A_c = Amplitude of carrier

μ = Modulation index

Dividing (1) by (2), gives

$$\frac{1+\mu}{1-\mu} = 3 \Rightarrow \mu = \frac{1}{2}$$

04. Ans: (c)

Sol: Superheterodyne improves selectivity and sensitivity.

05. Ans: (a)

Sol: (1) Maximum frequency deviation

= ±75kHz

(2) Frequency stability of the carrier

= ±2kHz

(3) Allowable bandwidth per channel

= 200kHz.

These values are prescribed by CCIR (Consultative Committee for International Radio).

06. Ans: (a)

Sol: $BW = 2(\beta + 1)f_m$

$= 2\beta f_m + 2f_m$

$= 2\Delta f + 2f_m$

Let $\Delta f = 75kHz$, and $f_m = 10kHz$ initially

$BW = 2\times 75 + 2\times 10 = 170KHz$

When $f_m = 20kHz$,

$BW = 2\times 75 + 2\times 20 = 190kHz$.

Therefore, BW is increased by 20 kHz.

07. Ans: (d)

Sol: $\psi_{PM}(t) = A\cos(\omega_c t + K_p m(t))$ ____(1)

$\psi_{FM}(t) = A\cos\left[\omega_c t + K_f \int_{-\infty}^{t} m(\alpha)d\alpha\right]$ ____(2)

Replacing m(t) in eq. (1) with $\int m(t)$

changes PM into FM.

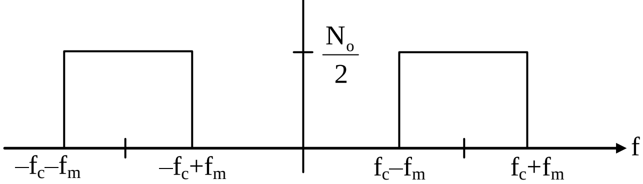
Similarly replacing m(t) in eq (2) with m′(t)

changes FM into PM.

08. Ans: (b)

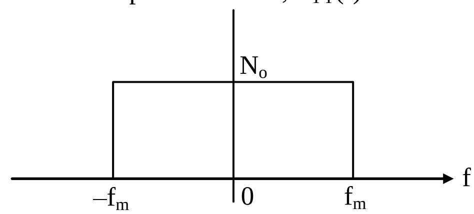
Sol:

Input noise PSD $S_{xx}(f)$

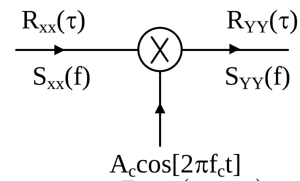


$\therefore$ Power of noise = $2N_of_m$ W

Output noise PSD, $S_{YY}(f)$



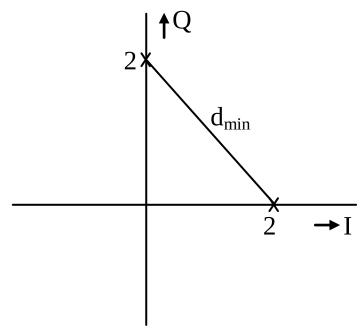
Note:



$$S_{YY}(f) = A_c^2\left[\frac{S_{xx}(f - f_c)}{4} + \frac{S_{xx}(f + f_c)}{4}\right]$$

09. Ans: (c)

Sol:



$d^2_{min} = 4 + 4 = 8, \ \frac{N_o}{2} = 1W/Hz$

$$P_{e\,\text{O–FSK}} = Q\left[\sqrt{\frac{d^2_{min}}{2N_o}}\right]$$

$$P_{e\,\text{O–FSK}} = Q\left[\sqrt{\frac{8}{2\times 2}}\right]$$

$$P_{e\,\text{O–FSK}} = Q\left[\sqrt{2}\right]$$

10. Ans: (b)

Sol: $BW_{BFSK} = \frac{2}{T_b} + [f_1 - f_2]$

11. Ans: (c)

Sol: Bandwidth efficiency factor (η) is given by,

$$\eta = \frac{\text{Bit rate}}{\text{BW}}$$

For BPSK, $\eta = \frac{R_b}{2R_b} = \frac{1}{2}$

For 64 PSK, $\eta = \frac{R_b \log_2 64}{2R_b} = \frac{6}{2}$

$\Rightarrow \frac{6/2}{1/2} = 6$

12. Ans: (d)

Sol: $\mu_Y = \mu_X |H(f)|_{at\, f=0}$

$|H(f)|_{f=0} = \int h(t)dt = \text{zero}$

Since $1/\pi t$ is odd signal, area under odd signal is always zero.

13. Ans: (a)

Sol: $f_s = 1.5 f_q$

$f_s = 1.5 \times 2f_m = 3\times5\times10^3$ samples/sec

$r_b = nf_s$

$\underset{PCM}{r_b} = 10\times15\times10^3 = 150\text{kbps}$

14. Ans: (c)

Sol: $\underset{\begin{bmatrix}\text{Delta}\\ \text{modulator}\end{bmatrix}}{N_q} = \frac{\Delta^2}{3} = \frac{1}{3}W$

15. Ans: (d)

Sol: For no slope overload distortion

$$\frac{\Delta}{T_s} \geq \left|\frac{d}{dt} m(t)\right|$$

Slope is $\frac{8}{2\times10^{-3}}$

$\Delta \times f_s \geq 4\times10^3$

$\Delta\times10^3 \geq 4\times10^3$

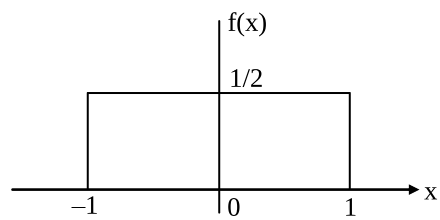
$\Rightarrow \Delta = 4$

16. Ans: (a)

Sol: The output bit sequence $\{b_k\}$ of Delta modulator will be Consecutive 1's and 0's or 0's and 1's.

17. Ans: (a)

Sol:



Noise power $(N_q) = \frac{\Delta^2}{12}$

$$\Delta = \frac{1-(-1)}{2^4} = \frac{2}{16} = \frac{1}{8}$$

$\therefore N_q = \frac{1}{64\times 12}$

Signal power S = $\int_{-1}^{1} x^2 \times \frac{1}{2} dx$

$\Rightarrow \frac{1}{2}\times\frac{1}{3}\times 2 = \frac{1}{3} W$

$\therefore \frac{S}{N_q} = \frac{1}{3}\times 12\times 64 = 256$

18. Ans: (b)

Sol: Phase deviation $\Delta\phi$ and β are same

$\Delta\phi = \beta = k_p A_m$

So 1 and 2 are incorrect

$\Delta f = \beta f_m = K_p A_m f_m$

So '3' is correct

$P_t = \frac{A_c^2}{2R}$ so '4' is incorrect

19. Ans: (c)

Sol: Companding is used to increase the signal to noise ratio and the value of 'A' is 87.6.

20. Ans: (c)

Sol: In T-1 system

No. of signals = 24, n = 8

$\frac{1}{T_s} = 8000$ a = 1

$R_b = 8000[24 \times 8 + 1]$

= 1.544 Mbps

number of bits/frame = 24×8 + 1

= 193 bits

21. Ans: (b)

Sol: E[X(t)] = 5

E[Y(t)] = E[X(t)]H(0)

The transfer function of a delay element is

$H(f) = e^{-j\omega T}$

$= e^{-j2\pi fT}$

H(0) = 1

E[Y(t)] = E[X(t)]H(0)

= 5×1

= 5

22. Ans: (c)

Sol: ACF at $\tau = 0$ is equal to $E[X^2(t)]$

ACF at $\tau = \infty$ is equal to $E^2[X]$

only 1 and 2 are correct

23. Ans: (c)

Sol: As we know, $g_m = \frac{2I_{DSS}}{|-V_P|}\left(1-\frac{V_{GS}}{V_P}\right)$

(or) $g_m = \frac{2\sqrt{I_D I_{DSS}}}{|-V_P|}$

$\Rightarrow g_m = \frac{2\sqrt{\frac{I_{Dss}}{16}\times I_{DSS}}}{|-V_P|} = \frac{2\sqrt{\frac{I_{Dss}^2}{16}}}{|-V_P|} = \frac{1}{2}\frac{I_{DSS}}{|-V_P|}$

$\Rightarrow g_m = \frac{1}{2}\times\frac{20\times 10^{-3}}{10} = 10^{-3} A/V$

$\Rightarrow g_m = 1 mA/V$

24. Ans: (c)

Sol: The thermal runway is avoided in self bias circuit because of the negative feedback produced by the emitter resistor.

25. Ans: (d)

Sol: For NMOS transistor

$\Rightarrow$ The substrate is of p-type semiconductor

$\Rightarrow$ Inversion layer is of n-type

$\Rightarrow$ V_{TN} (threshold voltage) is positive

26. Ans: (c)

Sol: For small value of V_{DS} ($V_{DS} << V_{GS} - V_T$), the MOSFET is in triode region

$$\therefore\ I_D = \mu_n C_{ox}\left(\frac{W}{L}\right)\left[(V_{GS} - V_T)V_{DS}\right]$$

$$\therefore\ \frac{dI_D}{dV_{DS}} = \mu_n C_{ox}\left(\frac{W}{L}\right)(V_{GS} - V_T)$$

$\therefore$ Drain ON resistance

$$= \frac{dV_{DS}}{dI_D} = \frac{1}{\mu_n C_{ox}\left(\frac{W}{L}\right)(V_{GS} - V_T)}$$

$\Rightarrow$ Drain ON resistance

$$\propto \frac{1}{\text{Overdrive Voltage } (V_{GS} - V_T)}$$

27. Ans: (c)

Sol: $\rightarrow$ For a JFET, at pinch off width of the induced channel becomes zero and the current becomes constant.

$\rightarrow$ A MOSFET must be operated in saturation region to use as an Amplifier.

28. Ans: (a)

Sol: Base narrowing in a BJT is referred as Early effect.

29. Ans: (d)

Sol: Given data $\Rightarrow$ I_C = 2mA, β = 249

$$g_m = \frac{I_C}{V_T} = \frac{2}{25} = 80\text{mA/V}$$

Voltage gain (A_V) = – $g_m(R_C // R_L)$

$= -80\times10^{-3}\times25\times10^{3}$

$= -2000$

30. Ans: (b)

Sol: The given circuit is a common collector amplifier for CC amplifier, Voltage gain $\left(\frac{V_0}{V_I}\right)$ is 1.

31. Ans: (d)

Sol: $g_m = 100 \times 10^{-3}$ A/V

base input resistor, $r_\pi = 5\text{k}\Omega$

$\therefore$ As we know, $r_\pi = \frac{\beta}{g_m}$

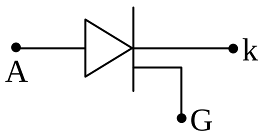
$\Rightarrow \beta = r_\pi\, g_m$

$\Rightarrow \beta_{min} = 5 \times 10^3 \times 100 \times 10^{-3}$

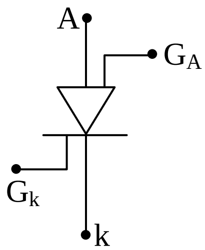
$\Rightarrow \beta_{min} = 500$

32. Ans: (a)

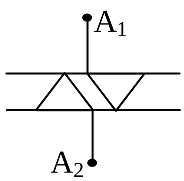
Sol:



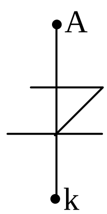
SCR



SCS



DIAC



Shockley diode

33. Ans: (a)

Sol: Latching current (I_L) is 2 to 3 times greater than holding current (I_L). So, statement (I) is wrong.

→ Snubber circuit is connect in parallel to protect SCR against $\frac{dv}{dt}$ triggering. So, statement (2) is wrong.

→ SCS is a four terminal unidirectional device with characteristics similar to SCR. So, statement (3) is correct

34. Ans: (a)

Sol: $N_A = 4.4\times10^{28}\times\frac{2}{2.5\times10^{8}} = P_P$

$$n_p p_p = n_i^2 \Rightarrow n_p = \frac{n_i^2}{p_p}$$

$$n_p = \frac{(2.5\times10^{19})^2}{8.8\times10^{28}}\times2.5\times10^{8} = 1.77\times10^{18}\ /\ m^3$$

35. Ans: (b)

Sol: The base width of a bipolar transistor is increased by a factor of three then collector current decreased by a factor of three

36. Ans: (d)

Sol: 1. $E_F^n = E_F^P$ since under open circuit condition fermi level is constant.

2. with forward bias E_0(eV) decreases means N side levels move up and hence E_F^n increases and E_F^p decreases.

3. With reverse bias E_0 (eV) increases and hence E_F^n decreases and E_F^P increases.

37. Ans: (d)

Sol: 1. Direct band gap semiconductors are used for the construction of laser's

2. Current amplification takes place in LASER

38. Ans: (a)

Sol: We know : $C_d = \frac{C_1 - n^2 C_2}{n^2 - 1}$

And given that C_1 = 200 PF, f_1 = 1MHz

$C_2 = ?$, $f_2 = 2MHz$

$C_d = 40$ PF

$$\Rightarrow 40PF = \frac{200PF - 4\times C_2}{3}$$

$$\Rightarrow 120PF = 200PF - 4\times C_2$$

$$\Rightarrow C_2 = \frac{200PF - 120PF}{4}$$

$$= \frac{80PF}{4}$$

= 20 PF

39. Ans: (b)

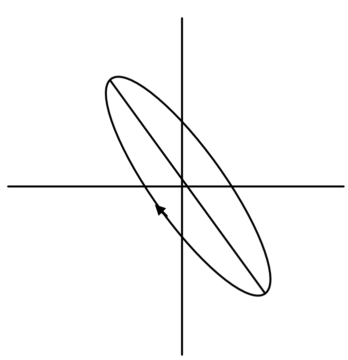
Sol: we know % error due to $C_d = \frac{-C_d}{C + C_d}\times 100$

$$\therefore |\%\ \text{error}| = \frac{C_x}{C_x + C_y}\times 100$$

40. Ans: (c)

Sol: The CRO uses electrostatic focusing instead of electromagnetic focusing which is used in a TV picture tube.

41. Ans: (d)



42. Ans: (b)

Sol: 2 & 4 are correct.

43. Ans: (b)

Sol: Let say n = number of steps required to be taken to reach to 428 mV

resolution = 10mV in 20volt range of operation

$$n = \frac{428mV}{10\,\frac{mV}{step}}$$

= 42.8 steps

= 42 steps

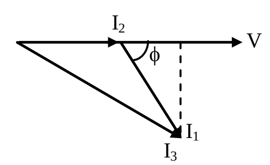
= 42 clocks

$\therefore$ if 42 clock pulses are counted, then displayed as 0 0. 4 2 V

20VR

44. Ans: (a)

Sol:



$$\bar{I}_3 = \bar{I}_1 + \bar{I}_2$$

$$\Rightarrow I_3^2 = I_1^2 + I_2^2 + 2I_1I_2\cos\phi$$

$$\cos\phi = \frac{I_3^2 - I_1^2 - I_2^2}{2I_1I_2}$$

45. Ans: (a)

Sol: Heaviside bridge measures mutual inductance interms of standard inductance.

Campbell modification of Heaviside bridge (standard 'L' interns of mutual inductance).

46. Ans: (c)

Sol: f = 1 MHz

Given time taken to increase voltage from 0 to 1.5 V is 100 ms

$\Rightarrow V_1 = 1.5$ V

$t_1 = 100$ms

$V_1 \propto t_1$

$$\Rightarrow \frac{V_1}{V_2} = \frac{t_1}{t_2}$$

$$\Rightarrow \frac{1.5}{0.75} = \frac{100\text{ms}}{t_2}$$

$$t_2 = \frac{100\text{ms}}{2} = 50 \text{ ms}$$

$\therefore$ n = $t_2 f = 50 \times 10^{-3} \times 10^{6} = 50{,}000$

$\therefore$ n = 50,000 pulses.

47. Ans: (b)

Sol: PMMC meter measures average value of current

$\therefore I_{avg} = 1$A

For full wave rectifier circuit,

$$I_{avg} = \frac{2I_m}{\pi} = 1$$

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

Also $I_{RMS} = \frac{I_m}{\sqrt{2}} = \frac{\pi}{2\sqrt{2}} = 1.11\text{A}$

48. Ans: (b)

Sol: (ii) True (i) False

i.e the compensating coil is designed to compensate the pressure coil current existing in the current coil.

$\therefore$ Compensates the effect of the Impedance of the voltage coil (or) potential coil circuit.

49. Ans: (c)

Sol: Given E = 2.5 V, L = 10m, ℓ = 1mm

$$\text{Voltage resolution} = \frac{E \times \ell}{L}$$

$$= \frac{2.5 \times 10^{-3}}{10} \text{V}$$

$$= 2.5 \times 10^{-4} \text{V}.$$

50. Ans: (c)

Sol: Springs of PMMC meter are in series with the coil and provide controlling torque. Aluminium former holds the coil and provide damping torque.

51. Ans: (c)

Sol: Relative errors gets added during multiplication and division

(a) total relative error = 2%+2%+2% = 6 %

(b) total relative error = 2%+2%+2% = 6 %

(c) total relative error = 2%+2% = 4 %

Option (c) has minimum relative error. therefore VI is chosen for power calculation.

52. Ans: (c)

Sol: PMMC $\rightarrow$ DC only

Rectifier $\rightarrow$ both AC and DC

MI with current T/F $\rightarrow$ AC only

Electrodynamometer $\rightarrow$ both AC and DC

53. Ans: (a)

Sol: Error = measured value – true value

– 0.5 = 120.5 – true value

$\therefore$ True value = 120.5 + 0.5 = 121.0

54. Ans: (b)

Sol: For the given voltmeter,

Guaranteed accuracy is ±2% of full scale reading.

$= \pm 0.02 \times 300 = \pm 6$ V

$\therefore$% Limiting error = $\frac{\pm 6}{360} \times 100$

$= \pm 1.66\%$

55. Ans: (b)

Sol: Creeping can be prevented by drilling two diametrically opposite holes in the disc.

In some cases a small piece of iron is attached to the edge of the disc. The force of attraction exerted by the brake magnet on the iron piece is sufficient to prevent creeping of disc.

56. Ans: (d)

Sol: To balance a bridge angle and magnitude condition must be satisfied.

The angle condition is $\theta_1 + \theta_4 = \theta_2 + \theta_3$

(i)) (0° to –90°)+0° = (0° to – 90°)+0°

(ii) –90° +(– 90°) $\neq$ 0°+0°

(iii) 0°+0°=–90° + 90°

(iv) (0° to –90°) +0°$\neq$(0° to + 90°)+0°

57. Ans: (b)

Sol: $P_1 = 2000$ W

$P_2 = 0$ W

$$\therefore \theta = \tan^{-1}\left(\sqrt{3}\frac{P_1 - P_2}{P_1 + P_2}\right)$$

$$= \tan^{-1}\left[\sqrt{3}\left(\frac{P_1}{P_1}\right)\right] = 60°$$

$P = P_1 + P_2 = 2000 + 0 = 2000$ W

$\tan\theta = \frac{Q}{P} \Rightarrow \tan 60° = \frac{Q}{2000}$

$\Rightarrow Q = \sqrt{3} \times 2000 = 3464.1$

58. Ans: (b)

Sol: Meter constant to given data

$$K = \frac{30x3600}{10x50} = 216 \text{ rev/kWh}$$

But it is given that meter constant is 200.

Therefore % error in meter constant

$$= \frac{216-200}{200} \times 100 = 8\%$$

59. Ans: (a)

Sol: Given system voltage i.e., primary voltage = 11000V

turn's ratio = 104

$$\Rightarrow \text{Actual secondary voltage} = \frac{11000}{104}$$

$$= 105.77\text{V}$$

Measured secondary voltage = 98V

$\therefore$ % error =

$$\frac{\text{measured value} - \text{true value}}{\text{true value}} \times 100$$

$$= \frac{98-105.77}{105.77} \times 100$$

$$= -7.346 \cong -7.35$$

$\therefore$ The magnitude of error is 7.35

60. Ans: (a)

Sol: Given G = –133, R = 1000 Ω

$$\frac{\left(\frac{\Delta R}{R}\right)}{e} = -133$$

Given e = 500 micro strain (compressive)

$$e = -500 \times 10^{-6}$$

$$\frac{\Delta R}{R} = 133 \times e$$

$$= -133 \times (-500 \times 10^{-6})$$

$$= 66500 \times 10^{-6}$$

$$\Delta R = 1000 \times 66500 \times 10^{-6}$$

$$\Rightarrow \Delta R = 66.5\ \Omega$$

$\because \Delta R$ = positive

$R_2 = R_1 + \Delta R$

$= 1000 + 66.5$

$R_2 = 1066.5\ \Omega$

61. Ans: (b)

Sol:

1. When capacitance of capacitance transducers is varied by varying area then

$$C = \frac{\varepsilon \ell x}{d}$$

$$\therefore \frac{\partial C}{\partial x} = S_x = \frac{\varepsilon \ell}{d} = \text{constant}$$

2. When capacitance is varied by changing the distance between the plates

$$C = \frac{\varepsilon_0 A}{d}$$

$$S_d = \frac{\partial C}{\partial d} = \frac{-\varepsilon_0 A}{d^2}$$

$\therefore$ Sensitivity is high for small values of d

3. Piezoelectric transducers are used for dynamic measurements and are not used for static measurements.
4. In piezoelectric transducers the capacitance of amplifier has to be low to avoid loading effects. So a low capacitance of amplifier means that impedance is high.

62. Ans: (c)

Sol: Given

$g = 12\times10^{-3}$ Vm/N

$F/A = 0.5 MN/m^2$

t = 2mm

we know voltage sensitivity $g = \dfrac{E/t}{F/A}$

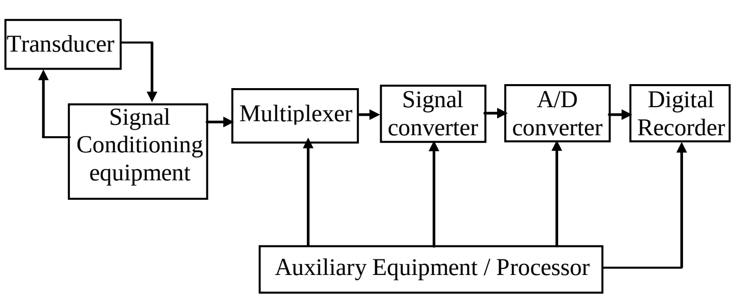
so, $E = g\times F/A \times t$

$= 12\times10^{-3}\times0.5\times10^{6}\times2\times10^{-3}$

= 12V.

63. Ans: (c)

Sol: A typical digital data acquisition system is as shown below



64. Ans: (b)

Sol: For distortion less output the Q-point in a voltage amplifier is selected in the middle of the active region. So, Statement (I) is correct.

Common base amplifiers has low input impedance and low current gain. So, Statement (II) is correct.

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

65. Ans: (c)

Sol: A transistor acts as a closed switch in saturation region.

So, Statement (I) is true

The current gain of CC amplifier is greater then that of CE amplifier.

So, Statement (II) is false.

66. Ans: (a)

Sol: For GaAs, the $\dfrac{I_p}{I_v}$ ratio is 15

$\left(\dfrac{I_p}{I_v} = 3.5 \text{ for silicon and } \dfrac{I_p}{I_v} = 8 \text{ for Ge}\right)$.

Therefore GaAs is preferred for tunnel diode. So, statement (I) is true.

The performance of tunnel diode is expressed in terms of the ratio of peak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AIR 4 SAURAV ME
AIR 4 AMAN GULIA CE
AIR 5 KUMAR MAYANK EE
AIR 5 AYUSH CHANDRA CE
AIR 6 RITESH LALWANI EE
AIR 6 PUSHPAK ME
AIR 6 KABIL BHARGABAVA CE
AIR 7 KARTIKEY SINGH EE
AIR 7 RAHUL JAIN E&T
AIR 7 MANISH RAJPUT ME
AIR 8 KULDEEP KUMAR E&T
AIR 8 HEMANT KUMAR ME
AIR 8 YOGESH KUMAR CE
AIR 9 DEEPITA ROY EE
AIR 9 SHUBHAM KARNANI E&T
AIR 9 D SABAPARA ME
AIR 9 ANKIT KUMAR CE
AIR 10 ANKITA SHARMA EE
AIR 10 GAURAV SRIVASTAVA E&T
AIR 10 SUMIT BHAMBOO ME
and many more...
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(EE: 9, E&T: 8, ME: 9, CE: 7) and many more...


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current to valley current $\left(\frac{I_p}{I_v}\right)$. Higher the value of $\frac{"I_p"}{I_v}$ better is the performance of tunnel diode. So, statement (II) is true, and correct explanation for statement (I).

67. Ans: (a)

Sol: The modulating signal directly controls the tank circuit of the carrier generator and hence, a stable oscillator like the crystal oscillator, cannot be used (The crystal oscillator provides a stable but fixed frequency). Thus carrier generation cannot be of high stability which is an essential requirement.

68. Ans: (b)

Sol: Thermal noise power is uniformly distributed to all frequency. So, Statement (I) is correct.

The mean of thermal noise is zero. Statement (II) is correct.

Statement I & II are correct but II is not the correct explanation of I.

69. Ans: (d)

Sol: In FM, bandwidth depends on frequency deviation & modulating signal frequency

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

70. Ans: (a)

Sol: The self-bias technique as used for a JFET can not be used for establishing an operating point for the enhancement MOSFET. So, Statement (I) is correct.

The voltage drop across R_S is such that it reverse biases the gate. So, Statement (II) is correct.

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

71. Ans: (a)

Sol: When MOSFET operates in saturation region, the inversion charge decreases from source to drain. So, statement (I) is true.

The channel potential increases from source to drain. So, statement (II) is true.

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

72. Ans: (a)

Sol: The signals usually to be examined are applied to the vertical deflection plates through attenuator and vertical amplifier to produce measurable deflection on the CRT screen. The horizontal deflection plates are fed by a sweep voltage that provides a time base. They can be fed directly when voltages of sufficient magnitude are used. So the variation in signal is obtained through vertical deflecting plate so it should have high sensitivity compared to horizontal plate.

73. Ans: (c)

Sol: PMMC instrument does not work satisfactorily when the frequency of the signal is high.

In PMMC instrument torque reverses if the current reverses. If this instrument is connected to ac supply having high frequency, the pointer cannot follow the rapid reversals and the deflection corresponds to mean torque which is zero. Hence these instruments cannot be used for ac.

74. Ans: (c)

Sol: Self-braking torque, which is caused by the revolution of disc in the field of series magnet under load conditions, is proportional to **square** of load current.

75. Ans: (a)