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ESE- 2019 (Prelims) - Offline Test Series Test-7

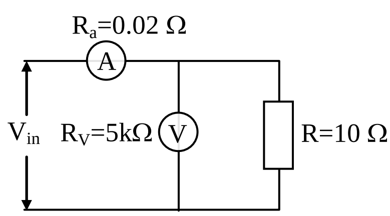
ELECTRONICS & TELECOMMUNICATION ENGINEERING

SUBJECT: ELECTRONIC MEASUREMENTS & INSTRUMENTATION, BASIC ELECTRONICS ENGINEERING (ELECTRONIC DEVICES & VLSI) AND ANALOG & DIGITAL COMMUNICATION SYSTEMS

SOLUTIONS

01. Ans: (c)

Sol: In both given connection methods, error caused by unknown resistance side meter i.e., in connection (a) ammeter and in connection (b) voltmeter.



If unknown resistance, R = $\sqrt{R_a \times R_V}$, the error caused in both methods are equal

Given: $R_a = 0.02\ \Omega$; $R_V = 5\ k\Omega$

$$R = \sqrt{0.02 \times 5k} = 10\ \Omega \text{ ; } R = 10\ \Omega \text{ (given)}$$

Therefore, any of the above two connection, as both of them give equal accuracy

02. Ans: (b)

Sol: $K = \dfrac{rev}{kWh}$

$$600 = \frac{rev}{\frac{600}{1000} \times \frac{1}{60}}$$

$$\frac{rev}{min} = \frac{600 \times 600}{1000 \times 60} = 6 \text{ rpm}$$

03. Ans: (b)

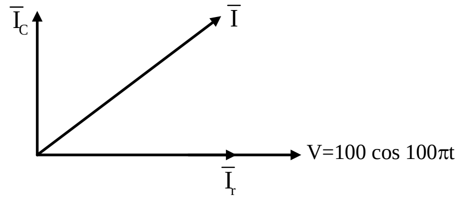
Sol: Since $T \propto B$ ($\because B = \phi/A$)

As we are using permanent magnets it has high field intensity.

$\therefore$ Torque is high in PMMC i.e, torque/weight ratio is high.

04. Ans: (b)

Sol: By taking voltage as reference



$$\therefore \bar{I} = \bar{I}_r + \bar{I}_c$$

$$\therefore |\bar{I}| = \sqrt{I_r^2 + I_c^2}$$

$$5 = \sqrt{4^2 + I_c^2} \Rightarrow I_c = 3A$$

05. Ans: (b)

Sol: $I_1 = 150 \pm 1A$, $I_2 = 250 \pm 2A$

$I = I_1 + I_2$

$d_1 = 1A$ and $d_2 = 2A$

$I = 400 \pm \sqrt{1^2 + 2^2}$

$= 400 \pm 2.24A$

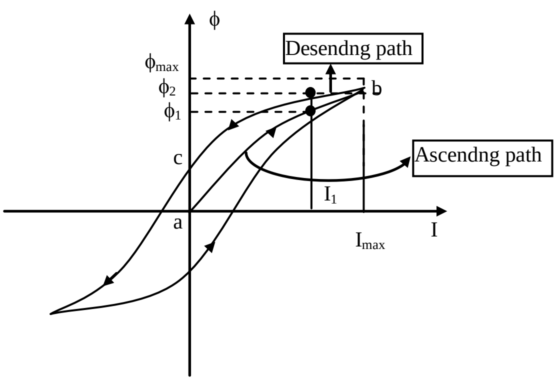
06. Ans: (b)

Sol: Dead zone is defined as the change in the physical variable to which the instrument doesn't respond

Lag (Minimum) is the time required by the instrument to begin to respond to a large in the measurement.

07. Ans: (c)

Sol: In moving Iron type instruments, flux produced due to the current flowing through the instrument don't follow a linear relationship in practical case because of hysteresis.



In ideal case we assume that $I \propto \phi \Rightarrow I = k\phi$

But when hysteresis is taken in account then $I = k\phi$ does not hold true.

In the above figure, when current is increased from 0 to I_{max} , ϕ increases from 0 to ϕ_{max}. But when current is decreasing from I_{max}, ϕ follows a different path along bc. Hence if we look closely, for the same current I_1, flux produced is greater in descending path [$\phi_2>\phi_1$] and hence it will indicate higher reading.

08. Ans: (a)

Sol: Secondary of a CT should not be open circuited as huge voltage will appear across its terminals when open circuited causing damage to insulation and may injure the operator operating the CT. But in PT, it can be open circuited as no such high voltage appears across it when open circuited.

09. Ans: (a)

Sol:

1. Given $T_d = KI$

$T_C = K_1\theta$ for spring control

$T_C = K_2\text{Sin}\theta$ for gravity control

At balance position

For spring:

$T_d = T_C$

$\Rightarrow K_1\theta = KI$

$$\Rightarrow \theta = \left(\frac{K}{K_1}\right)I \Rightarrow \text{linear scale}$$

For gravity:

$T_d = T_C$

$$\Rightarrow K_2\sin\theta = KI \Rightarrow \sin\theta = \frac{KI}{K_2}$$

$$\Rightarrow \theta = \text{Sin}^{-1}\left(\frac{KI}{K_2}\right) \Rightarrow \text{non linear}$$

2. Gravity control can be used only in vertically mounted systems.

10. Ans: (b)

Sol: Damping torque $T_D = \dfrac{B^2R^2dbt\omega}{K\rho}$

B = flux density of damping magnets

R = Radius of disc

ω = speed of rotation of the disc

ρ = resistivity of the disc

t = thickness of the disc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11. Ans: (c)

Sol: r_{sh} = 0.02 (fixed)

For R = 1000 Ω, full scale deflection (fsd) is obtained for a current of 25 A

∴ Voltage across the shunt is $V_s = 25 \times 0.02 = 0.5$ V

∴ Current through the meter for full scale deflection $i = \frac{V_s}{R} = \frac{0.5}{1000} = 0.5$ mA

∴ i = 0.5 mA

Now it is given that for I = 100 A deflection is 40%

For fsd $I = \frac{100}{40/100} = 250$ A

∴ $V_{sh} = I \times R_{sh} = 250 \times 0.02 = 5$ V

i = 0.5 mA

$\Rightarrow R = \frac{V_{sh}}{i} = \frac{5}{0.5\times10^{-3}} = 10^4\ \Omega \Rightarrow R = 10{,}000\ \Omega$

12. Ans: (b)

Sol: Precision resistor is a resistors that has very low tolerance value.

Ex: Wire wound resistors

13. Ans: (b)

Sol: Uncertainty distribution is used for analysis of single sample data

14. Ans: (b)

Sol: The disc should be conducting such that it provided path for eddy currents and at the same time it should be non-magnetic as it should not produce any magnetic field which can affect the working field.

15. Ans: (c)

Sol: $\tan\phi = \sqrt{3}\left[\frac{W_1 - W_2}{W_1 + W_2}\right]$

Reactive power consumed per phase, $Q = \frac{W_1 - W_2}{\sqrt{3}}$

$Q = \tan\phi\ \frac{W_1 + W_2}{3} = \frac{1}{\sqrt{3}} \times \frac{519}{3} = 100$ VAR

16. Ans: (c)

Sol: **Rayleigh's current balance:**

This instrument works on the principle that if a current carrying coil placed with its parallel to that of another current carrying coil with their axes coincident, there will be a force exerted between the coils. This force is proportional to the product of currents in the two coils and if the coils carry same current, the force is proportional to the square of the current. This force can be measured if one of the coils is movable and is suspended.

17. Ans: (c)

Sol: A swamping resistance of manganin having a resistance 20 to 30 time the coil resistance is connected in series with the coil and a shunt of manganin is connected across this combination. Since copper forms a small fraction of the series combination, the proportion in which the currents would divide between the meter and the shunt would not change appreciably with change in temperature.

18. Ans: (c)

Sol: Clamp on meters are used to measure the current flowing in a line with out breaking the circuit.

19. Ans: (c)

Sol: Phase angle error in current transformer is given by

$$\phi = \frac{I_m \text{Cos}\,\delta - I_e \text{Sin}\,\delta}{nI_s} \text{ rad.}$$

For inductive burdens δ is positive.

$\Rightarrow \phi$ is positive for small values of δ and

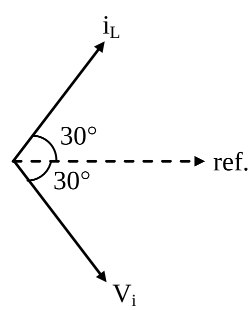
ϕ is negative for large values of δ

For capacitive burdens δ is negative.

$\Rightarrow \phi$ is positive irrespective of magnitude of δ.

20. Ans: (c)

Sol:



$\angle V_i$ & $i_L = 60°$

Wattmeter reading,

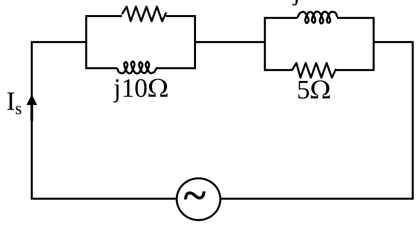
$$W = V_{rms} \times I_{rms} \times \cos\phi$$

$$= \frac{10}{\sqrt{2}} \times \frac{10}{\sqrt{2}} \times \frac{1}{2}$$

$$= 25 \text{ W}$$

21. Ans: (c)

Sol: If the galvanometer is short circuited then modified bridge circuit is shown below.



$$Z_{eq} = 2 \times \left(\frac{5\times j10}{5+j10}\right) = 4\sqrt{5}\angle 26.56$$

$$I_s = \frac{50\angle 0°}{4\sqrt{5}\angle 26.56} = 5.59\angle -26.56°$$

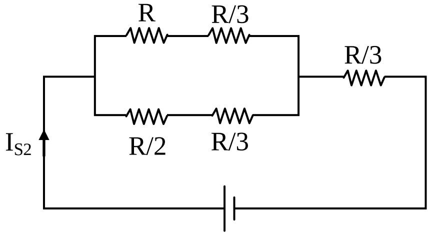
22. Ans: (c)

Sol: When balanced detector is open circuited

$$R_{eq} = 2R//\left[R + \left(R//2R\right)\right] = \frac{10R}{11}$$

$$I_{S1} = \frac{E}{R_{eq}} = \frac{11E}{10R} \quad \ldots\ldots\ldots\ldots (1)$$

when balanced detector is short circuited



$$R_{eq} = \frac{11R}{13} \quad ; I_{S2} = \frac{13E}{11R} \ldots(2)$$

$$\therefore \frac{I_{S1}}{I_{S2}} = \frac{11E}{10} \times \frac{11}{13E} = \frac{121}{130}$$

23. Ans: (d)

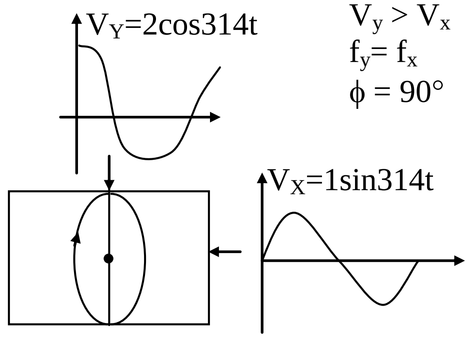
Sol: $V = \sqrt{2} \times 200 \sin(314\,\pi t)$

$I = \sqrt{2}\cos(314\,\pi t)$

$$P = \frac{1}{2} \text{ x } \sqrt{2} \text{ x } \sqrt{2} \text{ x } 200\sin(0^0) = 0 \text{ watt}$$

24. Ans: (b)

Sol:



Vertical Ellipse

$V_y > V_x$
$f_y = f_x$
$\phi = 90°$

25. Ans: (b)

Sol: A dual trace oscilloscope usually offers two modes-chop and alternate. Alternate mode is usually used for displaying high frequency wave forms while chop mode is used for displaying low frequency wave forms .

26. Ans: (c)

Sol: $R_{eff} = NR_i = 20 \times 1M\Omega = 20M\Omega$

27. Ans: (d)

Sol: $r = \dfrac{200V}{2\times10^4 \text{steps}} = 0.01V = 10$ mV

28. Ans: (c)

Sol: We know $T_1 = nTs$.............. for noise rejection

$$\Rightarrow 1000 \times \frac{1}{f_{clk}} = n \times \frac{1}{50Hz}$$

$$\Rightarrow f_{clk} = \frac{1000 \times 50Hz}{n}$$

$$\Rightarrow f_{clk\,max} = \frac{50kHz}{n_{min}}$$

$$\Rightarrow f_{clkmax} = \frac{50kHz}{1}$$

$$= 50kHz$$

29. Ans: (a)

Sol: Electronic DC voltmeter (like FET input voltmeter) offers very high resistance and sensitivity than electronic AC voltmeter like rectifier AC voltmeter

30. Ans: (d)

Sol: In full wave rectifier type voltmeter, deflection (θ) ∝ Average voltage

$\theta_1 \propto 12$ V

If an ac voltage of 15 V rms voltage is applied, then average voltage is

$$V_{avg} = \frac{1}{\pi}\int_0^{\pi} V_m \sin\theta d\theta$$

$$= \frac{V_m}{\pi}\int_0^{\pi} \sin\theta d\theta$$

$$= \frac{V_m}{\pi}\left[-\cos\theta\right]_0^{\pi}$$

$$= \frac{15\sqrt{2}}{\pi}[2]$$

$$= \frac{30\sqrt{2}}{\pi}$$

$$= 13.5 = 0.9 \times 15$$

Usually

$V_{dc} = 0.9\ V_{ac}$ (for a full wave rectifier)

$V_{dc} = 0.9 \times 15$

$V_{dc} = 13.5$ V

$$\frac{\theta_1}{\theta_2} = \frac{12}{13.5}$$

$$\frac{80}{\theta_2} = \frac{12}{13.5} \Rightarrow \theta_2 = \frac{13.5 \times 80}{12} \Rightarrow \theta_2 = 90°$$

31. Ans: (b)

Sol: For successive approximation ADC conversion time is same

∴ Conversion time for 5.1V input = 40μs

32. Ans: (c)

Sol: Dynamometer instrument is used as transfer instrument between A.C & D.C

Thermocouple based instrument is a true rms meter Ramp generator (or) saw tooth generator) is the time base generator in CRO.

Weston standard cell is standard of Emf.

33. Ans: (d)

Sol: Linear Variable Differential Transformer has one primary coil and two secondary coils connected in phase opposition i.e., 180° out of phase.

34. Ans: (d)

Sol: The least suitable transducer for static pressure measurement is piezoelectric transducer.

35. Ans: (c)

Sol: Thermocouple that can measure temperature in the range 1300° C to 1400° C is R type of thermocouple which has range of –50° C to 1768° C. Its composition is 87% platinum, 13% (platinum + Rhodium).

36. Ans: (a)

Sol: When GaAs is doped with silicon, the two possibilities arise

(i) Silicon can replace Gallium

(ii) Silicon can replace Arsenic

If the silicon replaces Gallium then silicon has one more electron. So, the extra electron is available for conduction. So, Silicon act as n-type dopants in Gallium. If Silicon replaces Arsenic it has one less electron. So, Silicon act as p-type dopants in Arsenic.

37. Ans: (a)

Sol: $N_A = 4.4\times10^{28}\times\dfrac{1}{2.5\times10^{8}} = P_P$

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

$n_p = \dfrac{(2.5\times10^{19})^2}{4.4\times10^{28}}\times2.5\times10^{8} = 3.55\times10^{18}/m^3$

38. Ans: (c)

Sol: The position of the intrinsic Fermi level of an undoped semiconductor is given by

$$E_{F_i} = \frac{E_C + E_V}{2} - \frac{KT}{2}\ln\frac{N_C}{N_V}$$

39. Ans: (a)

Sol: Einstein relation:

$$\frac{D_n}{\mu_n} = \frac{D_p}{\mu_p} = V_T = \frac{KT}{q} = \frac{T}{11600}$$

40. Ans: (b)

Sol: Statements 1, 2 and 3 imply one another. The examiner intends to know the consequence of the fact Si can be employed at higher temperature as compared to Ge, which is that Si can be employed in high power applications.

41. Ans: (a)

Sol: $G_{opt} = \dfrac{P_n'(0)}{\tau_{po}}$

$\Rightarrow P_n'(0) = G_{opt}\times\tau_{po} = 1.5\times10^{20}\times0.1\mu s$

$= 1.5\times10^{13}/cm^3$

$P_n(t) = P_{no} + P_n'(0)\, e^{-\frac{t}{\tau_p}}$

At t = 0

$P_n(0) = P_{no} + P_n'(0) \approx P_n'(0)$

42. Ans: (c)

Sol: Tunnel diode uses heavy doping i.e., 1 in 10^3 atoms. LED & LASER have two different emission phenomenon of light. LED follows spontaneous emission where as LASER follows stimulated emission and emitted light is coherent in nature.

43. Ans: (d)

Sol: LED operates in forward bias mode.
LCD use as a light reflectors/transmitters.
Opto-couplers are use in electrical isolator.
Photo diodes always operates in reverse biased mode.

44. Ans: (c)

Sol: $\alpha = 0.9$,

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.9}{1-0.9} = \frac{0.9}{0.1} = 9$$

$$\Rightarrow \text{change in } \alpha = \frac{0.9 \times 0.5}{100} = 4.5 \times 10^{-3}$$

$\alpha' = 0.9045$

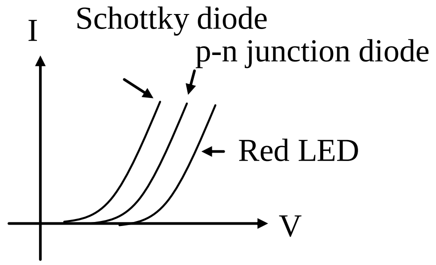
$$\beta' = \frac{\alpha'}{1-\alpha'} = 9.4712$$

% change in

$$\beta = \frac{\beta' - \beta}{\beta'} \times 100 = \frac{9.4712 - 9}{9.4712} = 5\%$$

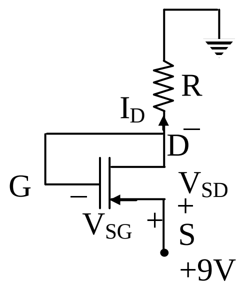
45. Ans: (b)

Sol:



46. Ans: (a)

Sol:



$$I_D = \frac{1}{2}K_n'\frac{W}{L}[V_{SG} - |V_T|]^2 \text{ and } V_{GS} = V_{DS}$$

$$0.1\times10^{-3} = \frac{1}{2}\times25\times10^{-6}\times\frac{W}{2\times10^{-6}}[-2.4-(-1.4)]^2$$

$$\Rightarrow W = \frac{0.4\times10^{-3}}{25} = 16\mu m$$

Apply KVL to the circuit

$9 = V_{SD} + I_D R$

$$\Rightarrow R = \frac{9 - V_{SD}}{I_D}$$

$$= \frac{9-2.4}{0.1\times10^{-3}}$$

$= 66k\Omega$

47. Ans: (d)

Sol: Electrons drift and diffuse in the opposite direction

Hole and electron diffusion current components are in the same direction

Hole and electron drift current components are in the same direction

Holes and electrons drift in opposite direction.

48. Ans: (b)

Sol: The Hall coefficient can be expressed as

$$R_H = \frac{p\mu_p^2 - n\mu_n^2}{q(p\mu_p + n\mu_n)^2} \Rightarrow \text{Statement (4) is wrong}$$

For p-type semiconductor, $p >> n \Rightarrow p\mu_p^2 >> n\mu_n^2$

$\Rightarrow R_H > 0$ (i.e. R_H is positive)

For n-type semiconductor, $n >> p \Rightarrow p\mu_p^2 << n\mu_n^2$

$\Rightarrow R_H < 0$ (i.e R_H is negative)

For metals, p = 0 $\Rightarrow R_H = \dfrac{-n\mu_n^2}{qn\mu_n}$

$\Rightarrow R_H < 0$ (i.e. R_H is negative)

For intrinsic semiconductor, $n = p = n_i$

$$R_H = \frac{p\mu_p^2 - n\mu_n^2}{q(p\mu_p + n\mu_n)^2} = \frac{1}{qn_i}\frac{\mu_p^2 - \mu_n^2}{(\mu_p + \mu_n)^2}$$

As, $\mu_n > \mu_p \Rightarrow R_H < 0$ (negative) $\Rightarrow$ Statement (1) is true

Hence, Hall coefficient is negative for metal and n-type semiconductor

Hall coefficient is positive for p-type semiconductor.

So, Statement (1) and statements (3) are true.

Statement (2) is false.

49. Ans: (c)

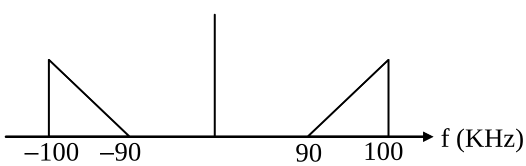
Sol: $\Delta = \dfrac{\text{Slope of the message signal}}{\text{samping rate}}$

$$\text{Sampling rate} = \frac{\text{Slope of the message}}{\Delta} = \frac{1000\pi}{2\pi/10} = 5000$$

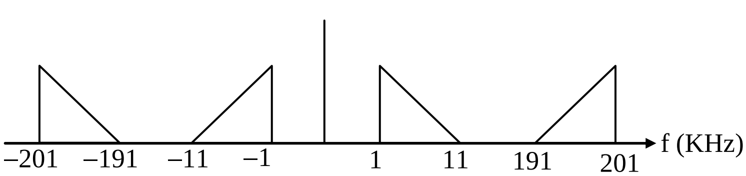
Pulse rate = $\dfrac{1}{T_s} = 5000 \text{ pulses/sec}$

50. Ans: (b)

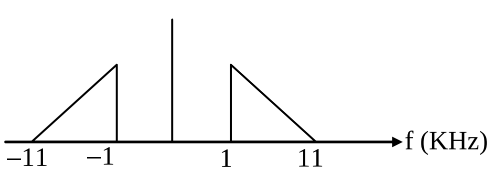
Sol: Spectrum at the output of SSB modulator



Spectrum at the output of mixer



Spectrum at the output of LPF



$\Rightarrow$ The maximum frequency component in the demodulated signal is 11 KHz

51. Ans: (c)

Sol: Noise power decreases by a factor of 16.

So step size is decreased by a factor of '4'

⇒ 'n' is increased from '4' to '6'

Or 'n' is increased by a 50%. So the bit rate increased by 50%

R_b = 10Kbps ×1.5 = 15 Kbps

52. Ans: (b)

Sol: Noise performance will be same if the figure of merit are same

i.e., $(FOM)_{FM} = (FOM)_{DSB}$

$$\frac{3}{2}\beta^2 = 1$$

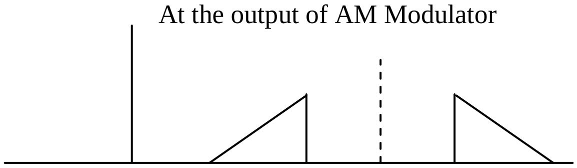
$$\beta^2 = \frac{2}{3}$$

$$\beta = \sqrt{\frac{2}{3}}$$

53. Ans: (d)

Sol: At the output of SSB modulator

At the output of AM Modulator



⇒ The bandwidth at the output of SSB modulator is 105-100 = 5KHz

⇒ Statement 1 is true

⇒ Spectrum is zero between 95 KHz to 100 KHz ⇒ Statement 2 is false

⇒ The bandwidth at the output of AM modulator is 1105K-895 K = 210 KHz

⇒ Statement 3 is false

⇒ Bandwidth of AM signal = 210 KHz

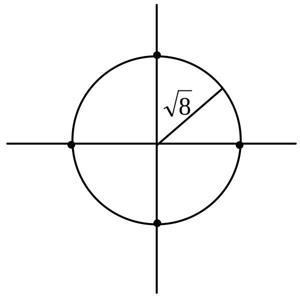
= 2(carrier frequency of SSB modulator) + 2 (message signal bandwidth) ⇒ Statement 4 is true

54. Ans: (d)

Sol: If the PSD is continuous, the power at a particular frequency is always zero.

55. Ans: (b)

Sol:



$r = \sqrt{E}$

$\Rightarrow E = 8$

$E_{av} = P_1E_1 + P_2E_2 + P_3E_3 + P_4E_4$

$$E_{av} = \frac{1}{2}\times 8 + \frac{1}{4}\times 8 + \frac{1}{8}\times 8 + \frac{1}{8}\times 8$$

$= 4 + 2 + 1 + 1$

56. Ans: (a)

Sol:
$$FOM = \frac{k_a^2 p}{1+k_a^2 p} = \frac{k_a^2 \frac{A_m^2}{3}}{1+k_a^2\frac{A_m^2}{3}} = \frac{\mu^2}{3+\mu^2}$$

$$FOM = \frac{(0.8)^2}{3+(0.8)^2} = \frac{0.64}{3.64}$$

$$\frac{\frac{s_0}{n_0}}{\frac{s_i}{n_i}} = \frac{0.64}{3.64}$$

$$\frac{10^3}{\frac{s_i}{n_i}} = \frac{0.64}{3.64}$$

$$\frac{s_i}{n_i} = \frac{10^3 \times 3.64}{0.64} = 5687.5$$

57. Ans: (c)

Sol: De-emphasis is used in FM receivers only to improve the signal to noise ratio at high frequencies. So, statement 2 is false.

58. Ans: (b)

Sol: 1. Matched filter used in digital communication receivers.
2. Impulse response of matched filter is s(T-t).
3. Filter is used to maximize the signal to noise ratio.

59. Ans: (a)

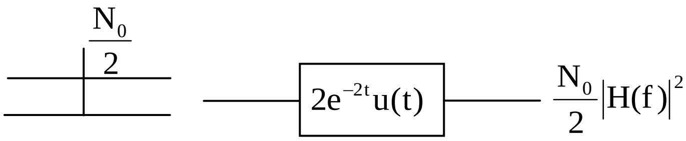
Sol: If $f_l > f_s$

$f_{si} = f_s - 2IF = 1000KHz - (2\times 50KHz)$

$= 900KHz$

60. Ans: (d)

Sol:



$$h(t) = 2e^{-2t}u(t)$$

$$H(\omega) = \frac{2}{2 + j\omega}$$

$$|H(\omega)|^2 = \frac{4}{4+\omega^2}$$

$$(PSD)_o = \frac{N_0}{2} \times \frac{4}{4+\omega^2}$$

$$(PSD)_o = \frac{2N_0}{4+\omega^2}$$

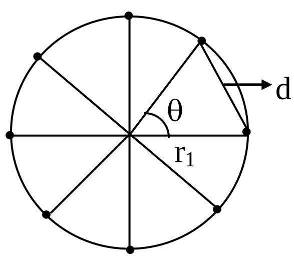
61. Ans: (d)

Sol: The minimum angular separation is

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

For example 8-psk

$$\theta = \frac{2\pi}{8} = 45^o$$



$$r_1 = \sqrt{E}$$

$$\sin\left(\frac{\theta}{2}\right) = \frac{\frac{d}{2}}{\sqrt{E}}$$

$$\frac{d}{2} = \sqrt{E}\sin\left(\frac{\theta}{2}\right)$$

$$d = 2\sqrt{E}\sin\left(\frac{\theta}{2}\right)$$

62. Ans: (c)

Sol: If a signal is transmitted there is a complete ambiguity about information transfer because the both probabilities are equal.

So, the mutual information is zero.

63. Ans: (c)

Sol: The probability of error for PSK is

$$P_e = Q\left[\sqrt{\frac{2E_b}{N_0}}\right]$$

Due to phase shift in Local oscillator

$$P_e = Q\left[\sqrt{\frac{2E_b \cos^2\theta}{N_0}}\right]$$

$$P_e = Q\left[\sqrt{\frac{2E_b \times 1}{4N_0}}\right]$$

$$P_e = Q\left[\sqrt{\frac{E_b}{2N_0}}\right]$$

64. Ans: (c)

Sol: Companding → To protect the small-signals in PCM from quantizing noise.
TDM → To use only one carrier frequency to handle different signals.
Source coding → To increase information transmission rate.
FDM→ To use different frequency bands for different signals.

65. Ans: (c)

Sol: 1. Capture effect observed in FM.
2. Slope overload distortion occurs in DM.
3. Matched filter used to demodulate PSK signals.
4. μ-law is used to compress high amplitude signals in PCM.

66. Ans: (c)

Sol: $R_{XY}(t_1 t_2) = E[X(t_1)Y(t_2)]$

$Y(t) = X(t) * h(t)$

$$Y(t) = \int X(t-\mu)h(\mu)d\mu$$

$$Y(t_2) = \int X(t_2-\mu)h(\mu)d\mu$$

$$R_{XY}(t_1 t_2) = E[X(t_1)\int X(t_2-\mu)h(\mu)d\mu]$$

$$= \int E[X(t_1)X(t_2-\mu)]h(\mu)d\mu$$

$$= \int R_X(t_2-t_1-\mu)h(\mu)d\mu$$

$$= \int R_X(\tau-\mu)h(\mu)d\mu$$

$$= R_X(\tau) * h(-\tau)$$

67. Ans: (d)

Sol: Air cored electrodynamometer type instruments are protected against external magnetic fields by enclosing them in a casing of **high** permeability alloy.

68. Ans: (a)

Sol: Shunts used with measuring instruments should have the following properties:

(i) The resistance temperature coefficient of shunt should be low and as nearly as possible to that of the instrument.

(ii) Resistance of shunts should be time invariant

(iii) They should have low thermal emfs with copper.

(iv) They should carry current without excessive temperature rise.

Manganin has a low temperature coefficient of resistance which is 40×10^{-6}1°C. Hence it is a preferred shunt material in DC instruments.

Constantan's thermal emf with copper, eventhough high, is unidirectional and hence it is used as a shunt in AC instruments.

69. Ans: (a)

Sol: Both statement (I) and statement(II) are individually true and statement (II) is the correct explanation of statement (I)

70. Ans: (d)

Sol: The rotating disc is aluminium disc and it is not a magnetic material.

71. Ans: (d)

Sol: Statement (I) is false, but statement (II) is true

72. Ans: (a)

Sol: Punch-through voltage is the one of the parameter which decides maximum voltage rating of a BJT.

73. Ans: (a)

Sol: A heavily doped semiconductor can exhibit a positive temperature coefficient of resistance for under these circumstances the material acquire metallic properties and resistance increases because of the decrease in carrier mobility with temperature.

74. Ans: (b)

Sol: In a lossless channel H(X/Y) = 0

So, I(XY) = H(X)

In a lossless channel the mutual information is same as the entropy of the transmitter.

⇒ Statement (I) is true.

In a deterministic channel H(Y/X) = 0

So, I(XY) = H(Y). In a deterministic channel, the mutual information is same as the entropy of the receiver.

⇒ Statement (II) is true.

So, both statements (I) and (II) are correct but statement (II) is not correct explanation of statement 1.

75. Ans: (d)

Sol: The frequency deviation in FM is $\Delta f = k_f A_m$

Where k_f = frequency sensitivity (Hz/volt)

A_m = amplitude of message signal

So, statement (I) is false & statement (II) is true.

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