ESE 2025
Prelims Solutions

Electronics & Telecom Engineering

Set-D

Scroll down

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Electronics & Telecom Engg. Paper Analysis of ESE 2025 Preliminary Examination		
Sl.	**Subjects**	**Number of Questions**
1.	Network Theory	9
2.	Electronic Devices and Circuits	5
3.	Analog Circuits	15
4.	Digital Circuits	3
5.	Materials Science	9
6.	Measurements	16
7.	Basic Electrical Engineering	12
8.	Control Systems	10
9.	Signals and Systems	10
10.	Electromagnetics	12
11.	Computer Org. & Architecture	9
12.	Microprocessors & Microcontrollers	6
13.	Communication Systems	10
14.	Advanced Communication	17
15.	Advanced Electronics	7

Q.1 An employee might learn many job skills, and each job skill might be learned by many employees. Database designers label the relationship "EMPLOYEE learns SKILL" as

(a) one-to-one relationship
(b) many-to-many relationship
(c) one-to-many relationship
(d) many-to-one relationship

Ans. (b)

Employee Table:

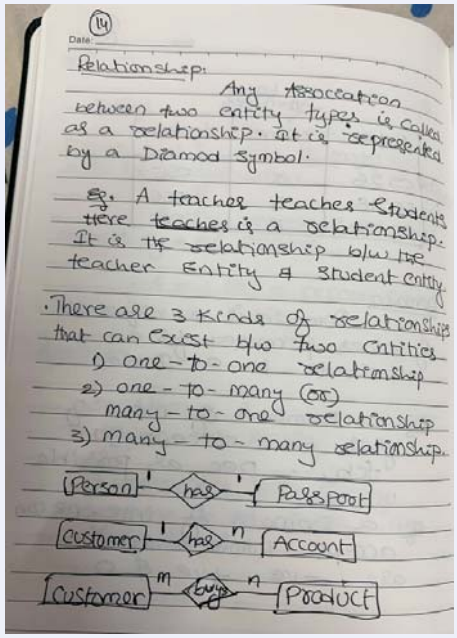
Employee-id	Name
101	Sagar
102	Ravi

Skill Table:

Skill-id	Skill name
101	COA
102	DBMS

Employee Skill (Junction Table (or) Relation)

Employee-id	Skill-id
101	101
101	102
102	101



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End of Solution

Q.2 In the 680X0 family, simple instructions are assigned short formats as follows:

ADD.L D1, D2

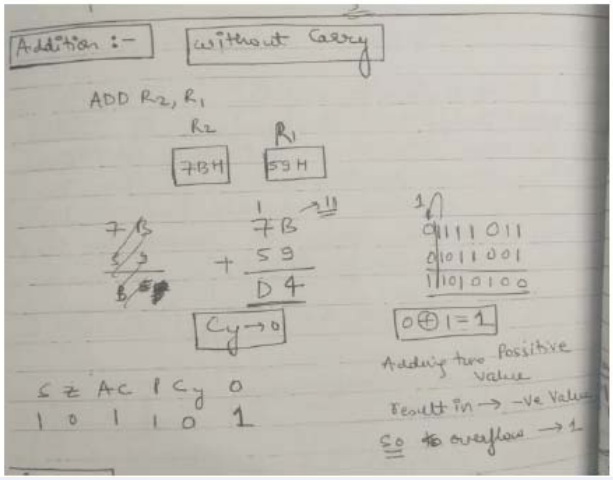
This instruction denotes

(a) register to register addition
(b) register to memory addition
(c) register to memory addition and register addition
(d) memory to memory addition

Ans. (a)

ADD.L D1, D2

Addition of D1 and D2 register and result is stored in 'D1' register.



Sol: 680x0 is a Motorola company based processor chip. The contents of registers D1 & D2 are added and the result is stored in D1. 'L' indicates, it is of Long type of data i.e 64-bit signed inter type. The similar instruction can be seen in the class notes.

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End of Solution

Q.3 Which one of the following is true for atomicity with respect to transaction properties?

(a) Requires that all operations of transactions be completed; if not transaction is aborted

(b) Indicates the permanency of the database's consistent state

(c) The results of the concurrent execution of several transactions

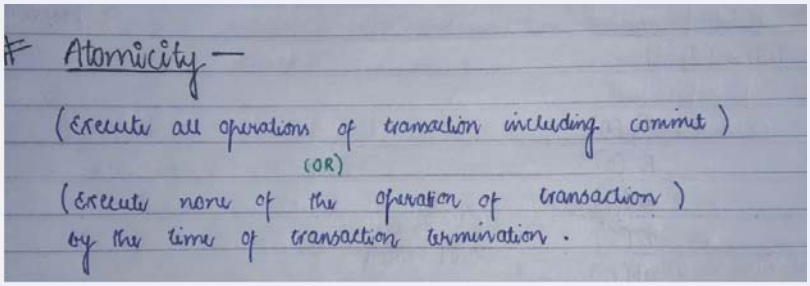
(d) The data used during the execution of a transaction cannot be used by a second transaction until the first one is completed

Ans. (a)

Rule: "Execute all the statements in the transaction including COMMIT"

(or)

"Execute None of the statements in the transaction.



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End of Solution

Q.4 A pulse of a given frequency transmitted upward is received back after a period of 5 milliseconds. If the value of the speed of light is 3×10^8 m/s, the virtual height of the reflecting layer will be

(a) 650 km (b) 700 km

(c) 750 km (d) 800 km

Ans. (c)

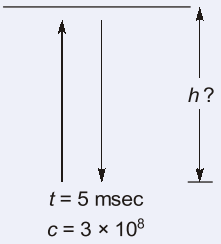
$\because \quad v = \frac{d}{t}$

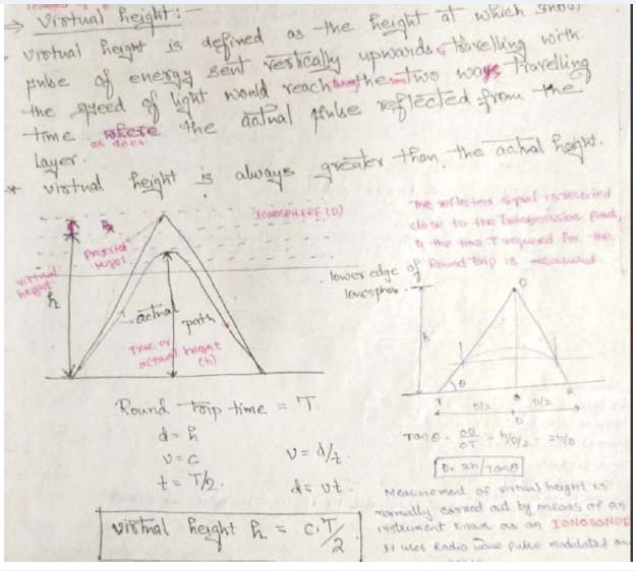
$\therefore \quad d = v \times t$

$\because \quad @t = 5$ msec, distance travelled is double

$\therefore \quad h = \frac{v \times t}{2} = \frac{3 \times 10^8 \times 5 \times 10^{-3}}{2}$

$\Rightarrow \quad h = 750$ km





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Q.5 The velocity factor V_f with respect to transmission line wave propagation is

(a) $\frac{V_p}{c}$ (b) $\frac{2V_p}{c}$

(c) $\frac{V_p}{3c}$ (d) $\frac{2V_p}{3c}$

where, V_p is actual velocity of propagation, c is velocity of propagation through free space

Ans. (a)

The velocity factor V_f is defined as the ratio of actual velocity of signal propagation on a transmission line to the speed of light in vacuum.

End of Solution

Q.6 A dielectric medium, in which the conduction current is almost nonexistent in comparison with the displacement current, may be treated as

(a) homogeneous dielectric medium (b) imperfect dielectric medium

(c) perfect dielectric medium (d) isotropic dielectric medium

Ans. (c)

When the conduction current is almost non-existent compared to displacement current, it implies the dielectric medium is a perfect dielectric.

End of Solution

Q.7 A load of pure resistance of 60 Ω is to be connected through a quarter-wave line to a transmission line of characteristic impedance 100 Ω. If VSWR = 1, the characteristic impedance of the quarter-wave line will be

(a) 82.5 Ω (b) 77.5 Ω

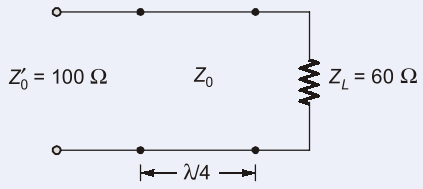
(c) 72.5 Ω (d) 67.5 Ω

Ans. (b)

Given, $S = 1$,

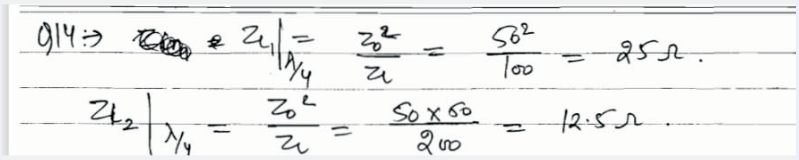
$Z_0 = ?$

$\because \quad |\Gamma| = \dfrac{S-1}{S+1} = \dfrac{1-1}{1+1} = 0$



$\therefore$ Z_L is perfectly matched to Z_0'

So, $Z_0 = \sqrt{Z_L \cdot Z_0'} = \sqrt{60 \times 100} \cong 77.5\ \Omega$



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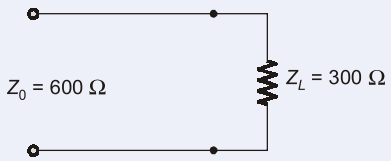
Q.8 A lossless transmission line having characteristic impedance of 600 Ω is terminated by a resistance of 300 Ω. The voltage standing wave ratio in the line will be

(a) 4 (b) 3

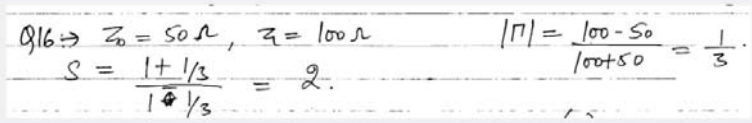
(c) 2 (d) 1

Ans. (c)



$$\text{As } \Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{300 - 600}{300 + 600} = \frac{-1}{3}$$

$$\therefore \quad S = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+\frac{1}{3}}{1-\frac{1}{3}} = \frac{3+1}{3-1} = 2$$



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End of Solution

Q.9 The antenna efficiency η (with regards to a radiation resistance) is

(a) $\frac{P_{rad}}{2P_{in}} \times 100$

(b) $\frac{P_{rad}}{P_{in}} \times 100$

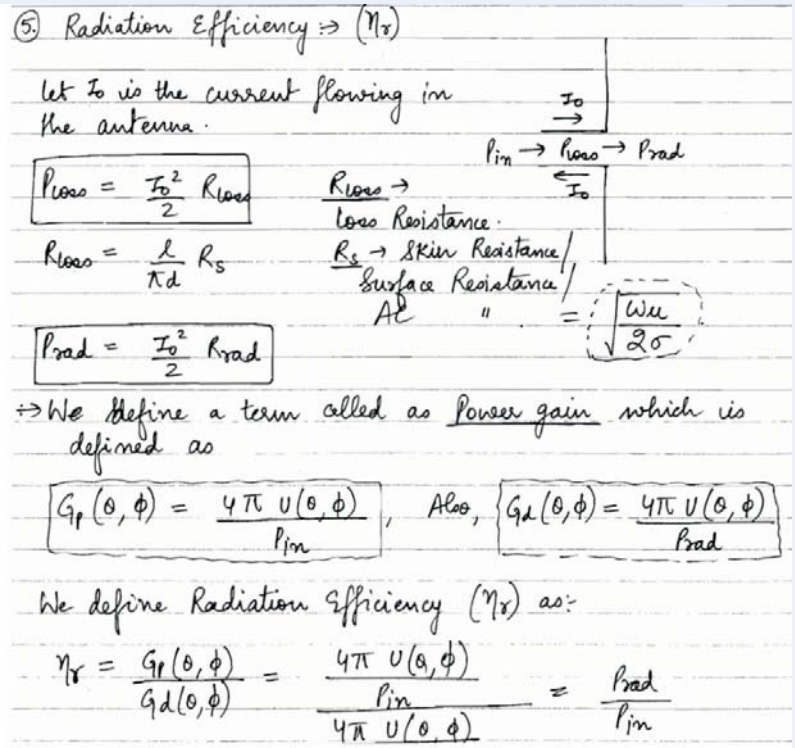
(c) $\frac{2P_{rad}}{P_{in}} \times 100$

(d) $\frac{3P_{rad}}{P_{in}} \times 100$

where P_{rad} is radiated power, P_{in} is input power

Ans. (b)

Antenna efficiency, $\eta = \frac{P_{rad}}{P_{in}} \times 100$



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End of Solution

Q.10 Which one of the following relations is true for an angle of entrance θ_e on the axis of core?

(a) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 + \eta_2^2}}{\eta_0}$ (b) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 - \eta_2^2}}{n_0^2}$

(c) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 - \eta_2^2}}{\eta_0}$ (d) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 + \eta_2^2}}{\eta_0^2}$

where, η_1 is index of refraction of core, η_2 is index of refraction of cladding, η_0 is index of refraction of external medium

Ans. (c)

From Snell's law,

$$n_0 \sin\theta_e = n_1 \sin\theta \quad ...(i)$$

$$n_1 \sin(90 - \theta) = n_2 \sin 90° \quad ...(ii)$$

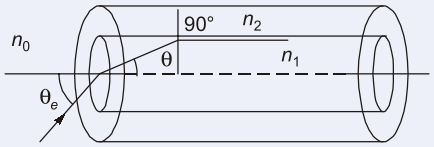
$$\Rightarrow n_1 \cos\theta = n_2$$

$$\Rightarrow \cos\theta = \frac{n_2}{n_1}$$

$$\Rightarrow \sqrt{1 - \sin^2\theta} = \frac{n_2}{n_1}$$

$$\Rightarrow \sin^2\theta = 1 - \frac{n_2^2}{n_1^2}$$

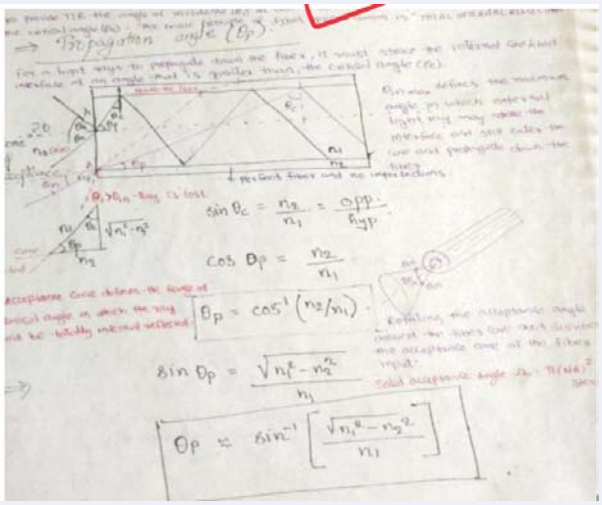
$$\Rightarrow \sin\theta = \frac{\sqrt{n_1^2 - n_2^2}}{n_1}$$



Put in (i), we get

$$n_0 \sin\theta_e = n_1 \times \frac{\sqrt{n_1^2 - n_2^2}}{n_1}$$

$$\therefore \sin\theta_e = \frac{\sqrt{n_1^2 - n_2^2}}{n_0}$$



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End of Solution

Q.11 When the cut-off frequency for TE_{10} mode is 3 GHz, and the value of v_0 is 3×10^{10} cm/s, the broad wall dimension of a rectangular waveguide will be

(a) 2 cm (b) 3 cm

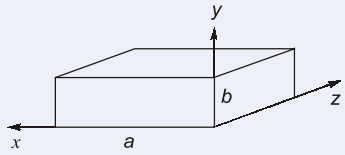
(c) 4 cm (d) 5 cm

Ans. (d)

Given, $f_c|_{TE_{10}} = 3$ GHz

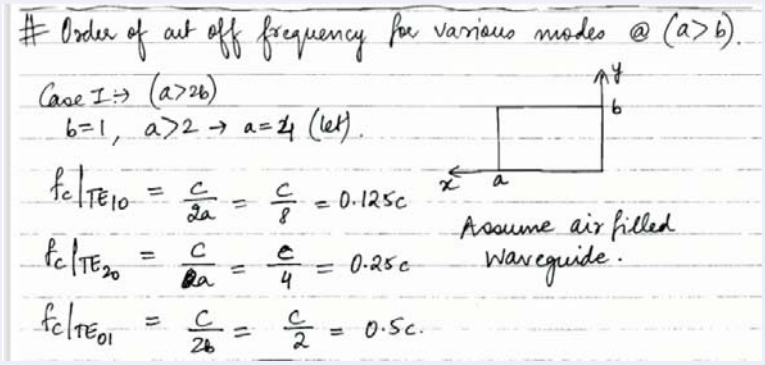
$v_0 = 3 \times 10^{10}$ cm/s $= c$

$a = ?$



$\because \quad f_c|_{TE_{10}} = \dfrac{c}{2a}$

$\therefore \quad a = \dfrac{c}{2f_c|_{TE_{10}}} = \dfrac{3\times10^{10}}{2\times3\times10^{9}} = 5 \text{ cm}$



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End of Solution

Q.12 The EM wave of 1 GHz is radiated by an antenna to cover a distance of 100 km. If the velocity of propagation is 3×10^8 m/s, the time taken by the wave to travel the above distance will be

(a) 369 μs (b) 351 μs

(c) 333 μs (d) 315 μs

Ans. (c)

Given, $f = 1$ GHz

$d = 100$ km

$v_p = 3 \times 10^8$ m/s

$t = ?$

$\therefore \quad t = \dfrac{d}{v_p} = \dfrac{100\times10^3}{3\times10^8} = 333 \,\mu\text{sec}$

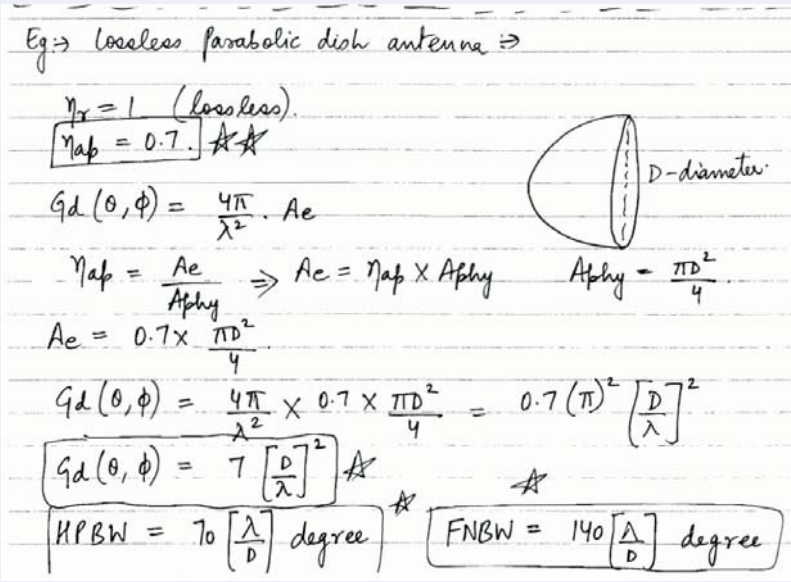
End of Solution

Q.13 The approximate –3 dB beam width for a parabolic antenna in degrees is

(a) $\theta = \frac{80\lambda}{D}$ (b) $\theta = \frac{70\lambda}{D}$

(c) $\theta = \frac{60\lambda}{D}$ (d) $\theta = \frac{50\lambda}{D}$

where, λ is wavelength, D is antenna mouth diameter, θ is beam width between half-power points (degrees)



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Ans. (b)

The HPBW of a parabolic antenna = $70\left(\frac{\lambda}{D}\right)$ degree.

End of Solution

Q.14 The guide wavelength λ_g for a cut-off frequency and frequency of operation is

(a) $\lambda_g = \dfrac{c}{\sqrt{f^2 - f_c^2}}$ (b) $\lambda_g = \dfrac{c}{\sqrt{f_c^2 - f^2}}$

(c) $\lambda_g = \dfrac{c}{\sqrt{f^2 + f_c^2}}$ (d) $\lambda_g = \dfrac{c}{\sqrt{f_c + f}}$

where, c is free space propagation velocity, f is frequency of operation, f_c is cut-off frequency

Ans. (a)

$$\because \quad \lambda_g = \frac{\lambda_{TEM}}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}} = \frac{c/f}{\frac{\sqrt{f^2 - f_c^2}}{f}} = \frac{c}{\sqrt{f^2 - f_c^2}}$$

7. Guide Wavelength: (λ_g)

$$\lambda_g = \frac{\lambda}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}} = \frac{\lambda}{\sqrt{1-\left(\frac{\lambda}{\lambda_c}\right)^2}}$$

NOTE : For wave propagation, $\lambda < \lambda_c$ and $\lambda_g > \lambda$.

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End of Solution

Q.15 A broadside array operating at 100 cm wavelength consists of four half-wave dipoles spaced 50 cm. If each element carries radio frequency current in the same phase and of magnitude 0.5 A and radiation resistance is 73 Ω, the radiated power will be

(a) 68 W (b) 73 W

(c) 78 W (d) 83 W

Ans. (b)

Given data

$\lambda = 100\,\text{cm}$

$N = 4$

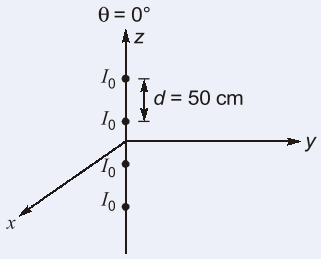
$d = 50\ \text{cm}$

$\alpha = 0°$

$I_0 = 0.5$

$R_{rad} = 73$

$P_{rad} = ?$



$$P_{rad} = I_{rms}^2 \times 73$$

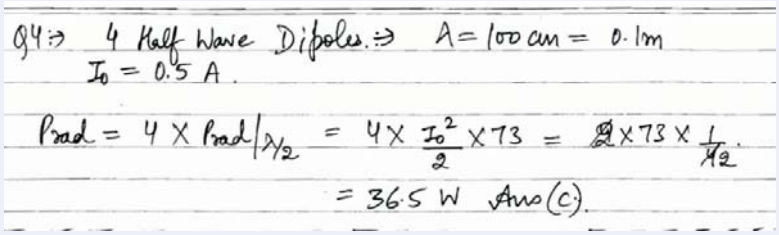
For four half wave dipoles,

$N = 4$

$$\therefore \quad P_{rad} = 4 \times I_{rms}^2 \times 73 = 4 \times (0.5)^2 \times 73 = 73$$

Hence, $P_{rad} = 73$ W

[The actual answer should be 36.5 W as I_0 is peak. But since options are not matching, it means they have taken it to be rms.]



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End of Solution

Q.16 A closed-loop control system has the characteristic equation

$$s^3 + 4.5s^2 + 3.5s + 1.5 = 0$$

As per Routh-Hurwitz criterion, the system will be

(a) stable (b) unstable

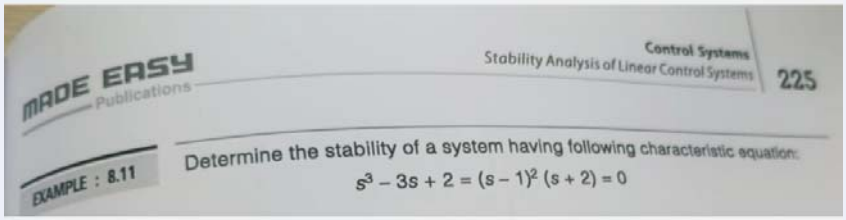
(c) absolutely unstable (d) semi-stable

Ans. (a)

RH table:

s^3	1	3.5
s^2	4.5	1.5
s^1	3.167	
s^0	1.5	

As all the coefficients of first column on RH table contains same sign, the system is stable.



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End of Solution

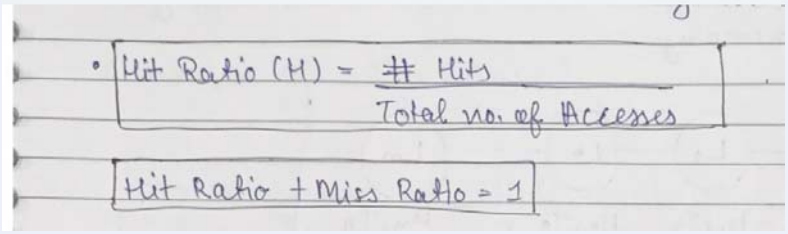
Q.17 In paging, the percentage of times that a page number is found in the associative registers is called

(a) effective memory access time (b) effective access time

(c) hit ratio (d) register ratio

Ans. (c)

$$\text{Hit Ratio} = \frac{\text{Number of Hits}}{\text{Total number of Accesses}}$$



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Q.18 Which one of the following is an effect of phase lead network?

(a) Phase margin is decreased

(b) Bandwidth is decreased

(c) The velocity constant is usually decreased

(d) The slope of the magnitude curve is reduced at the gain crossover is reduced at the result relative stability improves

Ans. (d)

The slope of the magnitude curve is reduced at the gain crossover is reduced at the result relative stability improves.

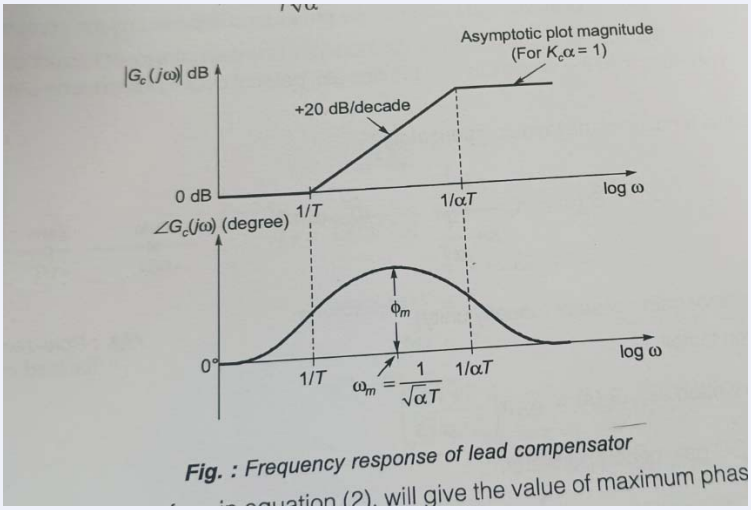

Fig. : Frequency response of lead compensator

equation (2), will give the value of maximum phas

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End of Solution

Q.19 For the first-order system with unit ramp function, the steady-state error is

(a) $\frac{1}{T}$ (b) 0

(c) T (d) 1

Ans. (c)

First-order system, $G(s) = \frac{1}{sT}$

Steady state error for ramp function,

$$e_{ss} = \frac{1}{k_v}$$

$$k_v = \lim_{s\to 0} sG(s) = \lim_{s\to 0} s\left[\frac{1}{sT}\right] = \frac{1}{T}$$

$$\Rightarrow \quad e_{ss} = \frac{1}{\left(\frac{1}{T}\right)} = T$$

Steady state error,

$$= \lim_{s\to 0} sE(s) \quad \text{(Using final value theorem)}$$

$$e_{ss} = \lim_{s\to 0} \frac{sR(s)}{1+G(s)H(s)}$$

Hence,

The steady state error ... error in a close-loop control system ... nput is shown in table below.

Table : Summary of the steady-state errors due to step, ramp and parabolic-function inputs for unity-...

Type of system	Error constants K_p	K_v	K_a	Steady-State Error e_{ss} Step Input $\frac{R}{1+K_p}$	Ramp input $\frac{R}{K_v}$	Parabolic $\frac{R}{K_a}$
0	K	0	0	$\frac{R}{1+K}$	∞	∞
1	∞	K	0	0	$\frac{R}{K}$	∞
2	∞	∞	K	0	0	$\frac{R}{K}$

... gives the following information:

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End of Solution

Q.20 A second-order system has a transfer function given by

$$G(s) = \frac{25}{s^2 + 8s + 25}$$

If the system initially at rest is subjected to a unit step input at $t = 0$, the second peak in the response will occur at

(a) πs (b) $\frac{\pi}{3}s$

(c) $\frac{2\pi}{3}s$ (d) $\frac{\pi}{2}s$

Ans. **(a)**

Given, transfer function,

$$G(s) = \frac{25}{s^2 + 8s + 25}$$

On comparing with standard second order system,

$$s^2 + 2\xi\omega_n s + \omega_n^2 = 0$$

$$\omega_n^2 = 25$$

$$\Rightarrow \quad \omega_n = 5 \text{ rad/s}$$

$$2\xi\omega_n = 8$$

$$\Rightarrow \quad \xi = \frac{8}{2\times\omega_n} = \frac{8}{2\times 5} = 0.8$$

For second peak, $t_p = \frac{3\pi}{\omega_d} = \frac{3\pi}{\omega_n\sqrt{1-\xi^2}}$

$$\Rightarrow \quad t_p = \frac{3\pi}{5\times\sqrt{1-(0.8)^2}} = \frac{3\pi}{3}$$

$$\Rightarrow \quad t_p = \pi$$

End of Solution

Q.21 Which one of the following is **not** the correct advantage of frequency domain analysis?

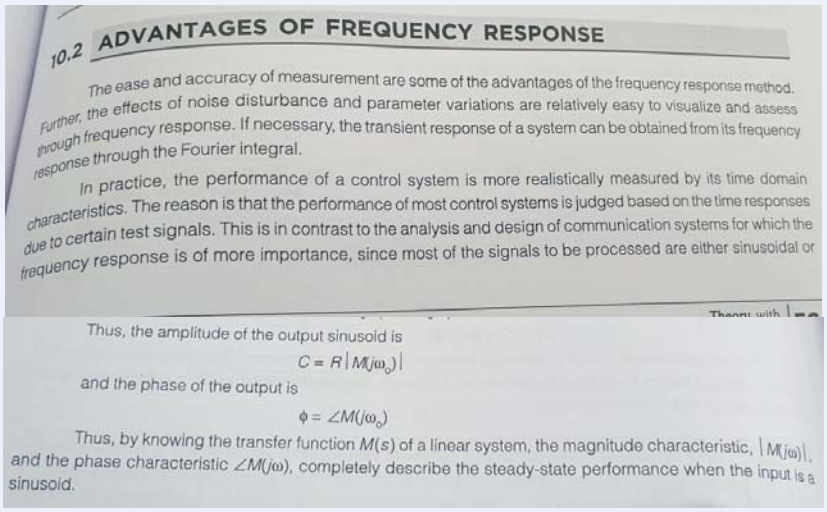
(a) Frequency response tests are simple to perform

(b) Those systems which do not have rational transfer function, frequency response can be precisely applied to them also

(c) Transfer function can be obtained from frequency response of the system

(d) Frequency response methods can be applied for non-linear systems

Ans. (d)



10.2 ADVANTAGES OF FREQUENCY RESPONSE

The ease and accuracy of measurement are some of the advantages of the frequency response method. Further, the effects of noise disturbance and parameter variations are relatively easy to visualize and assess through frequency response. If necessary, the transient response of a system can be obtained from its frequency response through the Fourier integral.

In practice, the performance of a control system is more realistically measured by its time domain characteristics. The reason is that the performance of most control systems is judged based on the time responses due to certain test signals. This is in contrast to the analysis and design of communication systems for which the frequency response is of more importance, since most of the signals to be processed are either sinusoidal or

Thus, the amplitude of the output sinusoid is

$$C = R|M(j\omega_0)|$$

and the phase of the output is

$$\phi = \angle M(j\omega_0)$$

Thus, by knowing the transfer function $M(s)$ of a linear system, the magnitude characteristic, $|M(j\omega)|$, and the phase characteristic $\angle M(j\omega)$, completely describe the steady-state performance when the input is a sinusoid.

MADE EASY Study Material

End of Solution

Q.22 In computer memory, for the non-random access memory, an average time T_N to read or write N bits is

(a) $T_A + \frac{n}{R}$ (b) $R + \frac{n}{T_A}$

(c) $n + R + \frac{1}{T_A}$ (d) $\frac{R}{T_A} + n$

where R is rate of transfer, n is number of bits, T_A is average access time

Ans. (a)

Average time = Average Access time + Transfer time

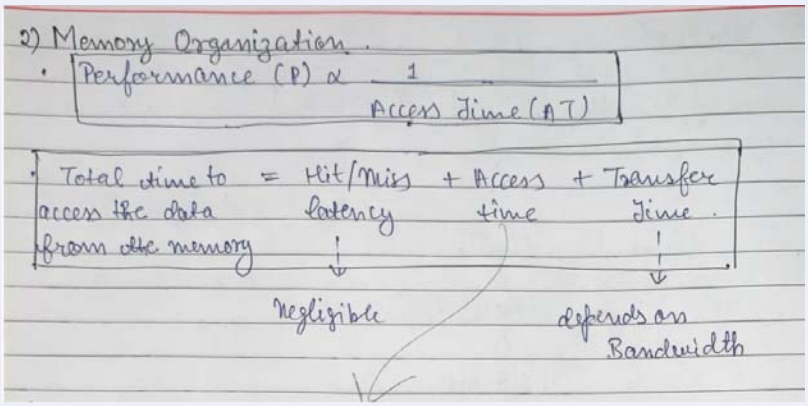
$$= T_A + \frac{n}{R}$$

Here,

Transfer time : R bits ——— 1 sec

n bits ——— ?

$$\Rightarrow \frac{n}{R}\text{sec}$$



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End of Solution

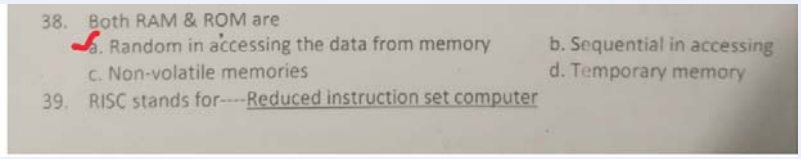
Q.23 A fundamental characteristic of a memory is the order or sequence in which information can be accessed. If storage locations can be accessed in any order and access time is independent of the location being accessed, the memory is termed as

(a) sequential access memory
(b) random access memory
(c) serial access memory
(d) optical memory

Ans. (b)

RAM → Random access memory

The time required to access any memory location is same in RAM.


38. Both RAM & ROM are
a. Random in accessing the data from memory
b. Sequential in accessing
c. Non-volatile memories
d. Temporary memory
39. RISC stands for----Reduced instruction set computer

MADE EASY Study Material

End of Solution

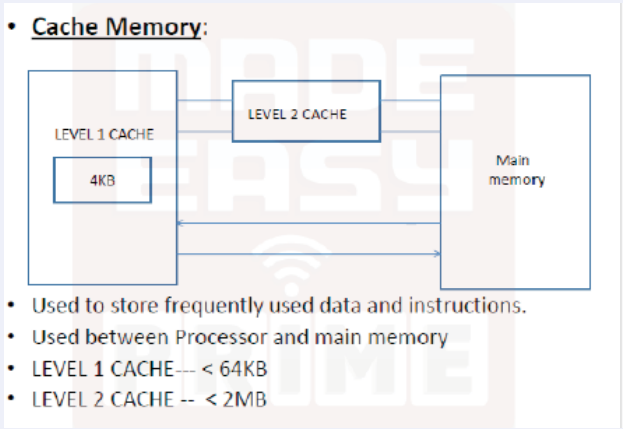
Q.24 Which one of the following is a small, fast memory that acts as a buffer for a slower, larger memory?

(a) SRAM
(b) DRAM
(c) Cache memory
(d) Flash memory

Ans. (c)

Cache memory

'Cache memory' is used to stored frequently used data and instructions to increase the speed of operation.



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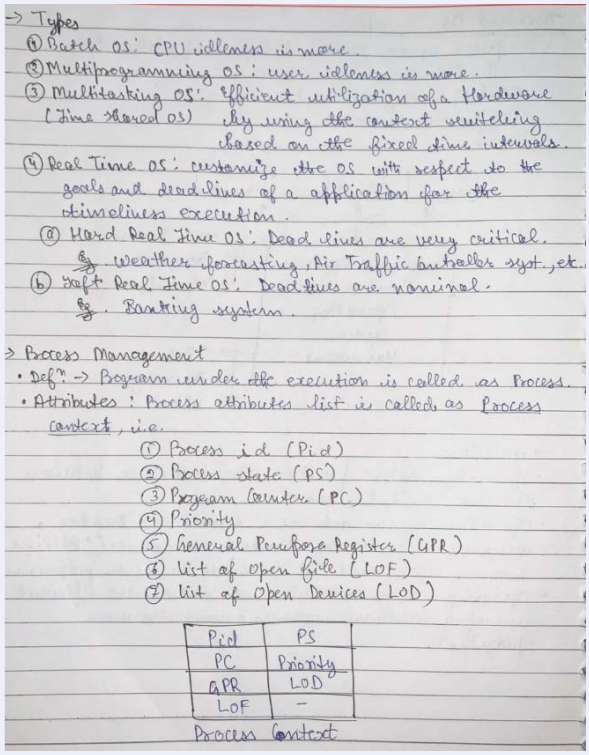
End of Solution

Q.25 Which of the following applications are characterized by the presence of many single-threaded processes?

(a) Java applications
(b) Multi-threaded native applications
(c) Multi-instance applications
(d) Multi-process applications

Ans. (d)

Multi-process application is designed to run using multiple operating system processes which may be single threaded (or) multi-threaded run in parallel.



MADE EASY Class Notes

End of Solution

Q.26 If c is the number of check bits required to achieve single-error correction with n-bit data words, clearly the check bits have 2^c patterns that must distinguish between $n + c$ possible error locations and the single error-free case, then c must satisfy the inequality of

(a) $2^c \geq n + c + 1$ (b) $2^c \leq n + c + 1$

(c) $2^{c-1} \geq n + c + 1$ (d) $2^{c-1} \leq n + c + 1$

Ans. (a)

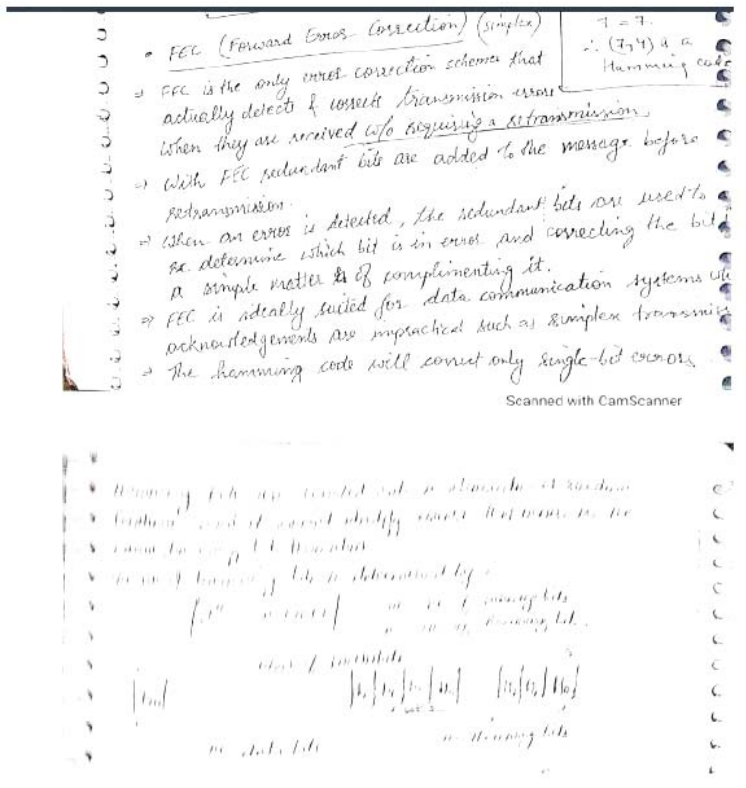
c is the number of check bits

n is the number of data bits

The check bits have 2^c patterns

These patterns must distinguish between $n + c$ possible error locations and the single error free case

$$2^c \geq n + c + 1$$



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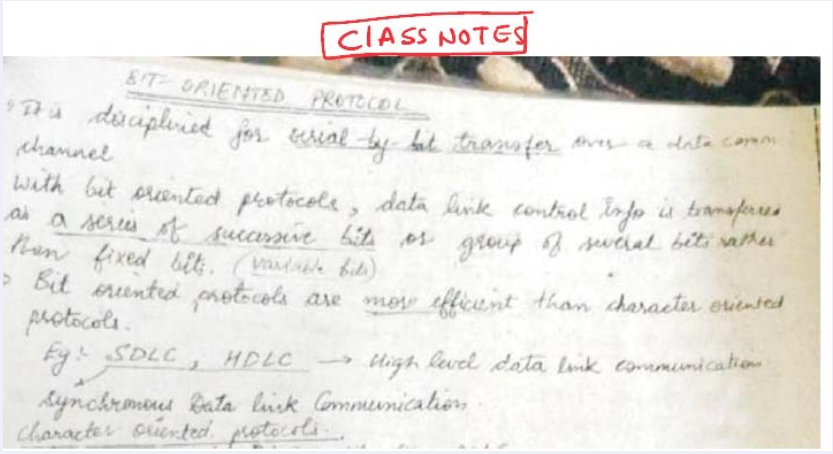
End of Solution

Q.27 Which one of the following protocols allows the transaction of serial bit stream of any length without the implication of character boundaries?

(a) Bit-oriented protocol
(b) Check redundancy protocol
(c) Parity bit protocol
(d) Byte-oriented protocol

Ans. (a)

Bit oriented protocol transmits data as a continuous stream of bits without any pre defined boundaries between characters or bytes.



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End of Solution

Q.28 In which one of the following data transfer modes, the CPU momentarily stops the task for processing, branches to a service program to process the I/O transfer, and then returns to the task it was originally performing?

(a) Programmed I/O
(b) Interrupt-initiated I/O
(c) Direct memory access
(d) Hybrid memory transfer

Ans. (b)

Interrupt initiated I/O

When CPU is interrupted, the next instruction address is pushed on to stack and the program is transferred to ISR (Interrupt service routing) and after completion returns to main program.

CALL 16 Bit address-----3B, 5 , 18

When call is executed

- The value of PC / address of the instruction next to CALL is pushed on stack , therefore SPSP –2
- The control of the program is transferred to subroutine address.

****The sequence of steps for an Interrupt or Call instruction are similar except that the flag register contents are also Pushed the by CPU automatically into Stack memory unlike in "CALL" instruction where the programmer has to store.**

MADE EASY Study Material (Handout)

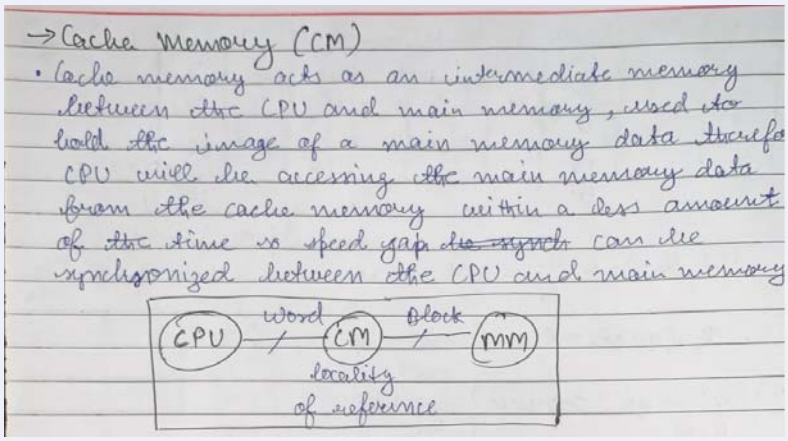
End of Solution

Q.29 A collection of blocks that logically belong on the disk but are being kept in memory for performance reason is known as

(a) block cache
(b) stream cache
(c) segment
(d) page

Ans. (a)

Cache is used to improve the performance of a memory with a principle of "Locality of Reference".



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End of Solution

Q.30 A virus that could overwrite the master boot record or boot sector with devastating results is known as

(a) boot sector virus
(b) bootstrap virus
(c) memory-resident virus
(d) cavity virus

Ans. (a)

A boot sector virus is a particular kind of virus that affects the Master Boot Record of hard drives and the boot sector of floppy discs.

End of Solution

Q.31 Which one of the following, a polycrystalline material of high purity, is the raw material for the preparation of single-crystal silicon?

(a) Electronic Grade Silicon (EGS)
(b) Metallurgical Grade Silicon (MGS)
(c) Float Zone Silicon (FZS)
(d) Raw Silicon (RS)

Ans. (a)

A high purity, polycrystalline material, often referred to as electronic-grade silicon (EGS), is indeed the primary raw material for producing single crystal silicon.

End of Solution

Q.32 For a 1000 μm long bond pad locus, the number of bond pads placed on a 100 μm pitch along a bond pad will be

(a) 10
(b) 11
(c) 12
(d) 13

Ans. (a)

Given, Total length of band pad = 1000 μm

pitch = 100 μm

$$\therefore \text{Number of band pads} = \frac{\text{Total length of band pad}}{\text{pitch}}$$

$$= \frac{1000\ \mu m}{100\ \mu m} = 10$$

End of Solution

Q.33 Which one of the following incorporates both the level sensitivity and the scan path approach using shift registers?

(a) Built-in logic block observer
(b) Built-in test
(c) Level-sensitive scan design
(d) I_{DQ} test

Ans. (c)

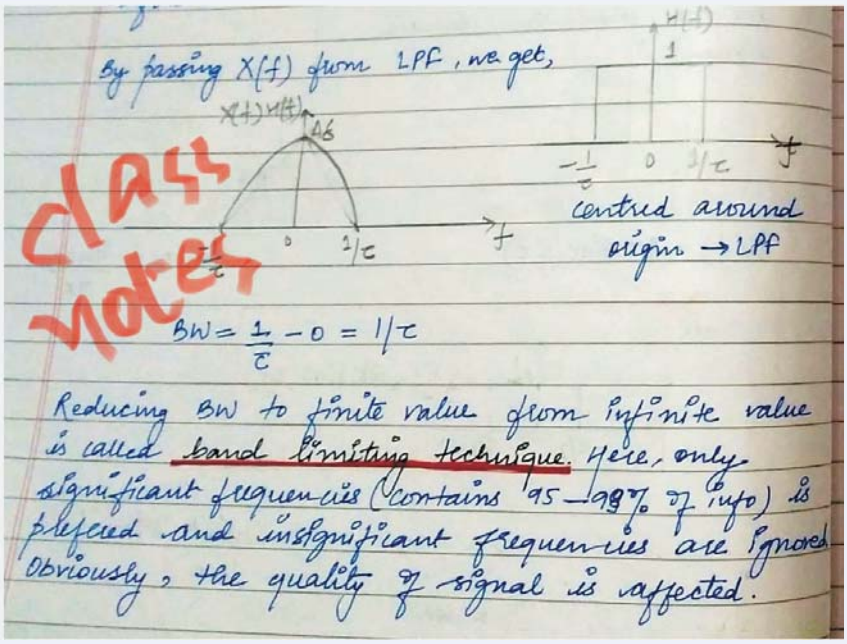
The design that incorporates level sensitivity and the scan patch approach using shift registers is called "Level-sensitive scan design".

End of Solution

Q.34 In a reconstruction filter, if the output is $x(t)$ in time domain and $C_0X(f)$ in frequency domain with no frequency components above f_h and $X(f)$ is zero for $|f| \geq f_h$, then such signal is called

(a) reconstructed
(b) bandlimited
(c) constructed
(d) delimited

Ans. (b)



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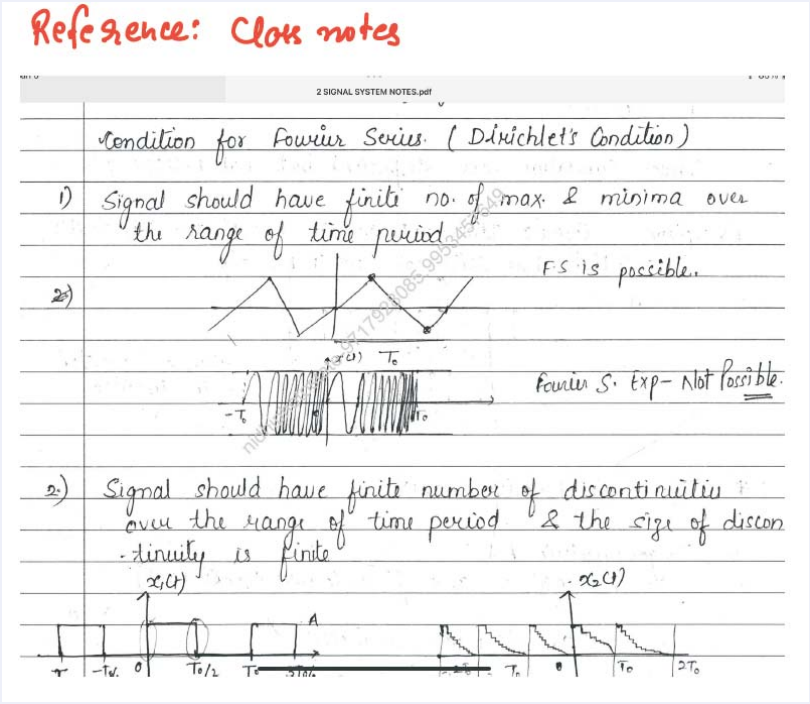
End of Solution

Q.35 Fourier series exists only when the function $f(t)$ is well-defined and single-valued, possesses finite number of discontinuities, and finite number of positive and negative maxima in the period T. These conditions are called

(a) Parseval's conditions
(b) Blackman conditions
(c) Chebyshev conditions
(d) Dirichlet's conditions

Ans. (d)

Reference: Class notes



MADE EASY Class Notes

End of Solution

Q.36 If $X(z)=\dfrac{1+\frac{1}{2}z^{-1}}{1-\frac{1}{2}z^{-1}}$, what is $x(n)$?

(a) $\frac{1}{2}[\delta(n)+2u(n-1)]$

(b) $\left(\frac{1}{2}\right)^n[\delta(n)+2u(n-1)]$

(c) $\left(\frac{1}{2}\right)^n[\delta(n)-2u(n-1)]$

(d) $\frac{1}{2}[\delta(n)-2u(n-1)]$

Ans. (b)

$$X(z)=\frac{1+\frac{1}{2}z^{-1}}{1-\frac{1}{2}z^{-1}}=1+\frac{z^{-1}}{1-\frac{1}{2}z^{-1}}$$

Take inverse z-transform on both sides,

$$x(n)=\delta(n)+\left(\frac{1}{2}\right)^{n-1}u(n-1)$$

$$=\left(\frac{1}{2}\right)^n\delta(n)+2\cdot\left(\frac{1}{2}\right)^n u(n-1) \qquad \left[\because\left(\frac{1}{2}\right)^n\delta(n)=\delta(n)\right]$$

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

Reference : class notes

Time Shifting Property

$x(n-n_0) \rightleftharpoons X(z)\,z^{-n_0}$

eg: $x(n)=2^n u(n) \rightleftharpoons X(z)=\dfrac{1}{1-2z^{-1}}$ $|z|>2$ For other no change in ROC.

$x(n-3) \rightleftharpoons z^{-3}X(z)=\dfrac{z^{-3}}{\cdots}$ ROC $|z|>2$

MADE EASY Class Notes

End of Solution

Q.37 A first-order low-pass Butterworth active filter has a cut-off frequency of 10 kHz and unity gain at low frequency. The voltage transfer function magnitude at 12 kHz for the filter will be

(a) 0.32 (b) 0.64
(c) 0.96 (d) 1.28

Ans. (b)

$$|H(f)| = \frac{1}{\sqrt{1+\left(\frac{f}{f_c}\right)^{2N}}} = \frac{1}{\sqrt{1+\left(\frac{12\times10^3}{10\times10^3}\right)^{2+1}}} \quad [\because N = 1]$$

$$= 0.64$$

End of Solution

Q.38 The filters that exhibit symmetry, have an odd-numbered filter length and are used in applications like decimation and interpolation are known as

(a) half-band filters (b) full-band filters
(c) bridge-band filters (d) multi-band filters

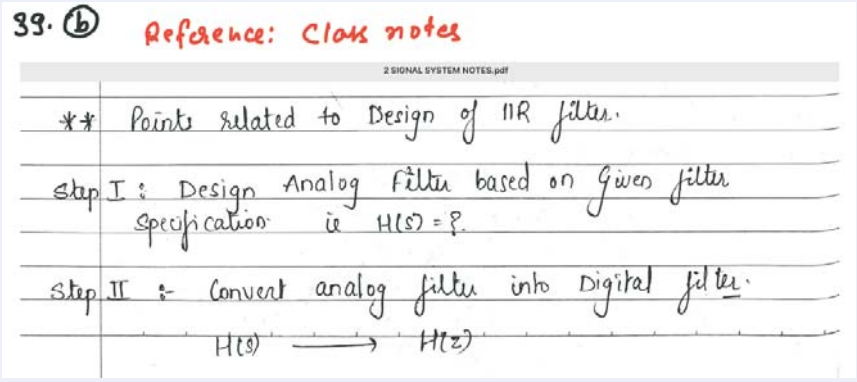
Ans. (a)

End of Solution

Q.39 The IIR filters involve designing of

(a) analog filter in analog domain and transforming into digital domain
(b) digital filter in analog domain and transforming into digital domain
(c) analog filter in digital domain and transforming into analog domain
(d) digital filter in digital domain and transforming into analog domain

Ans. (b)



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End of Solution

Q.40 If a pulse sent to the target returns after 15 μs, when the velocity of light is 300×10^6 m/s, the distance of the target will be

(a) 4.25 km (b) 3.50 km

(c) 2.25 km (d) 1.50 km

Ans. (c)

$$T = 15 \times 10^{-6} \text{ s}$$

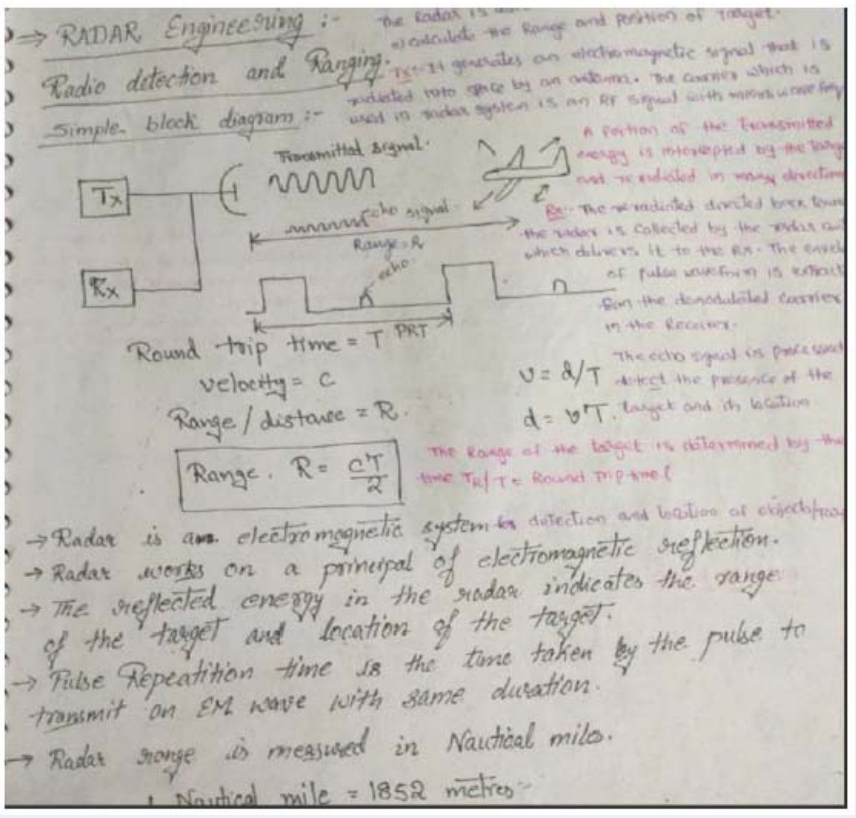
$$C = 300 \times 10^6 \text{ m/s}$$

$$d = \frac{CT}{2}$$

$$d = \frac{300 \times 10^6 \times 15 \times 10^{-6}}{2} \text{mts}$$

$$d = 2250 \text{ mts}$$

$$d = 2.25 \text{ kms}$$



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End of Solution

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Q.41 Pulse Width Modulation (PWM) mode is commonly used in embedded system application for

(a) controlling the speed of DC motors
(b) serial communication
(c) counting the electrical pulses
(d) recording the arrival time of either a rising or falling pulse

Ans. (a)

End of Solution

Q.42 A chip with fewer transistors results into lower cost, less heat, and less power requirements. These features are very desirable in small battery-powered embedded systems such as mobile phones. Which one of the following architectures is used?

(a) AMD
(b) MIPS
(c) ARM
(d) TDP

Ans. (c)

Small, battery-powered embedded systems like mobile phones commonly utilize a microcontroller-based architecture. This architecture often incorporates a processor core like ARM. ARM processors are widely used in mobile devices due to their low power consumption and high performance.

End of Solution

Q.43 Which kind of deposition has traditionally been done at higher temperatures to ensure that all the Si atoms being deposited are incorporated into lattice sites in order to obtain a single-crystal thin film?

(a) Epitaxial Si deposition
(b) Polysilicon deposition
(c) Silicon nitride deposition
(d) Silicon dioxide deposition

Ans. (a)

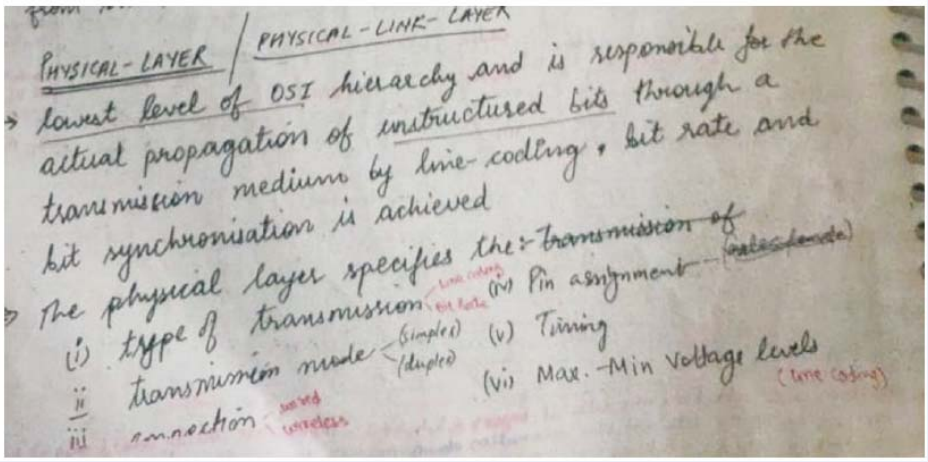
Epitaxial silicon deposition, which aims to create a single-crystal thin film, is typically performed at high temperatures. This ensures that all silicon atoms are properly incorporated into lattice sites of the substrate.

End of Solution

Q.44 Which one of the following layers defines the procedure and functions that physical devices and interfaces have to perform for transmission to occur?

(a) Data link layer
(b) Network layer
(c) Physical layer
(d) Application layer

Ans. (c)



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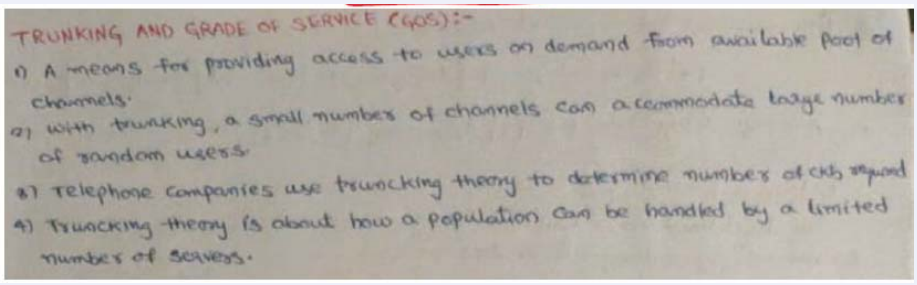
End of Solution

Q.45 Which one of the following carries multiple voice frequency circuits using either frequency division multiplexed or synchronous time division multiplexed?

(a) Subscriber
(b) Local loop
(c) Exchange
(d) Trunk

Ans. (d)

Trunk lines connect two exchanges and carry multiple voice channels.



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End of Solution

Q.46 An AM broadcast transmitter has a carrier power output of 50 kW. With 80% of modulation, the total power produced will be

(a) 66 kW (b) 58 kW
(c) 50 kW (d) 42 kW

Ans. (a)

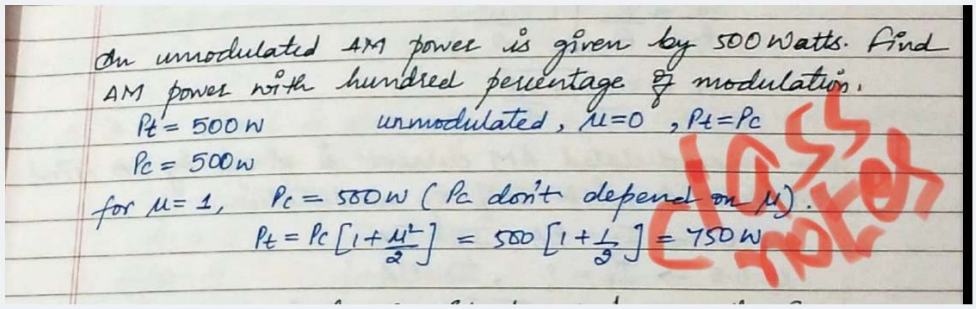
Given, $P_c = 50$ kW

$\mu = 0.8$

$$P_t = P_c\left[1+\frac{\mu^2}{2}\right]$$

$$= 50k\left[1+\frac{0.64}{2}\right]$$

$$= 66 \text{ kW}$$



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End of Solution

Q.47 A transmitter operates from a 12 V supply with a collector current of 2 A. If the modulation transformer has a turns ratio of 4 : 1, the load impedance seen by the audio amplifier will be

(a) 78 Ω (b) 82 Ω
(c) 88 Ω (d) 96 Ω

Ans. (d)

Given, $V = 12$ V

$I = 2$ A

$$Z_{in} = \frac{12}{2} = 6\ \Omega$$

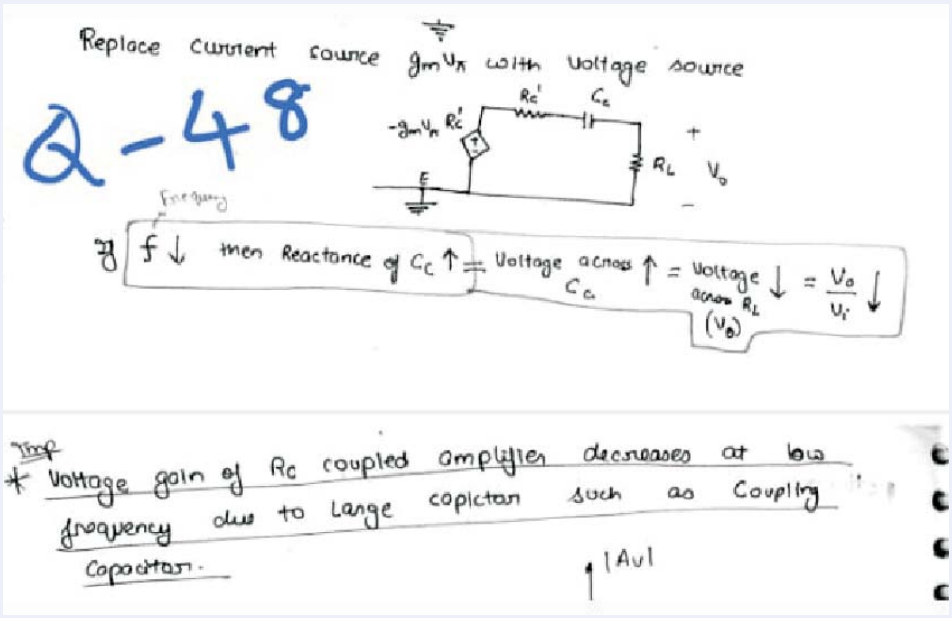
For transformer, $$Z_L = \left(\frac{N_1}{N_2}\right)^2 Z_{in} = \left(\frac{4}{1}\right)^2 \times 6 = 96\ \Omega$$

End of Solution

Q.48 The fall of $|A_v|$ and the increase of θ over 180° with decreasing frequency in the low frequency range are accounted by the

(a) coupling capacitors
(b) inter-electrode capacitors
(c) current gain of BJT (β)
(d) wiring capacitors

Ans. (a)



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End of Solution

Q.49 Which one of the following is particularly useful when large amounts of code are needed to handle infrequently occurring cases?

(a) Dynamic loading
(b) Static loading
(c) Dynamic binding
(d) Static binding

Ans. (a)

Dynamic loading allows loading code only when it is actually needed. This saves memory and improves performance-perfect for handling rarely occurring conditions without bloating the program upfront. Dynamic loading is a technique where code (usually in the form of libraries (or) modules) is load into memory only when needed at runtime rather than at startup (or) compile time.

End of Solution

Q.50 For a Pulse Amplitude Modulated (PAM) transmission of voice signal having maximum frequency equal to 2.5 kHz, if the sampling frequency is 10 kHz and the pulse duration is one-tenth of the sampling period, the transmission bandwidth will be

(a) 60 kHz (b) 50 kHz
(c) 40 kHz (d) 30 kHz

Ans. (b)

Given, $f_{max} = 2.5$ kHz

$f_s = 10$ kHz

Pulse duration $T_p = \frac{T_s}{10}$

Theoretical transmission bandwidth of PAM signal,

$$B.W = \frac{1}{2T_p}$$

$$= \frac{5}{T_s} = 5f_s = 50 \text{ kHz}$$

Q.29 A speech signal is sampled at 8 kHz and encoded into PCM format using 8 bits/sample. The PCM data is transmitted through a baseband channel via 4-level PAM. The minimum bandwidth (in kHz) required for transmission is _____.

[GATE-2016]

End of Solution

Q.51 $S(t)$, the output ASK signal for $kT < t \leq (k+1)T$, is

(a) $Am(t)\ \omega_c(t + kT)$ (b) $Am(t))\ \omega_c(t - kT)$
(c) $Am(t)\ \cos\omega_c(t + kT)$ (d) $Am(t)\ \cos\omega_c(t - kT)$

where T is the time width, k is an integer constant, t is the continuous time variable, ω_c is the carrier frequency, $m(t)$ is the modulating signal, A is the amplitude of the output signal.

Ans. (d)

End of Solution

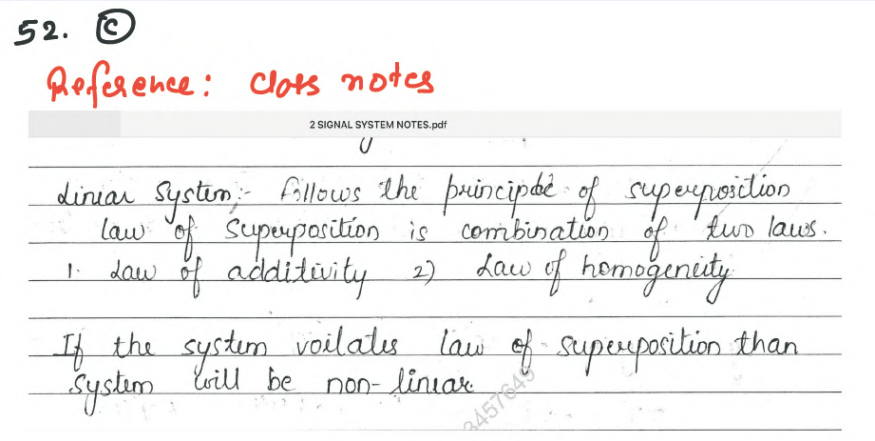
Q.52 Which of the following statements are correct?

1. A system is said to be linear if it obeys the principle of superposition
2. A system is said to be linear if it satisfies the homogeneity property.
3. A system is said to be non-linear if it obeys the principle of superposition.

Select the correct answer.

(a) 1 and 3 only
(b) 2 and 3 only
(c) 1 and 2 only
(d) 1, 2 and 3

Ans. (c)



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End of Solution

Q.53 An optical fiber has a bandwidth-distance product of 500 MHz-km. If a bandwidth of 85 MHz is required for a particular mode of transmission, the maximum distance that can be used between repeaters will be nearly

(a) 5.9 km
(b) 9.7 km
(c) 13.5 km
(d) 18.3 km

Ans. (a)

$$BW \times d = 500 \text{ MHz-km}$$

$$BW = 85 \text{ MHz}$$

$$d = ?$$

$$d = \frac{BW \times d}{BW} = \frac{500 \text{ MHz-km}}{85 \text{ MHz}}$$

$$d = \frac{500}{85} \text{km}$$

$$d = 5.9 \text{ km}$$

End of Solution

Q.54 A single-mode fiber has a numerical aperture of 0.15. What is the maximum core diameter it could have for use with infrared light with a wavelength of 820 nm?

(a) 8.4 μm (b) 6.3 μm

(c) 4.2 μm (d) 2.1 μm

Ans. (c)

$$NA = 0.15$$

$$\text{diameter} = 2a = ?$$

$$\lambda = 820 \text{ nm}$$

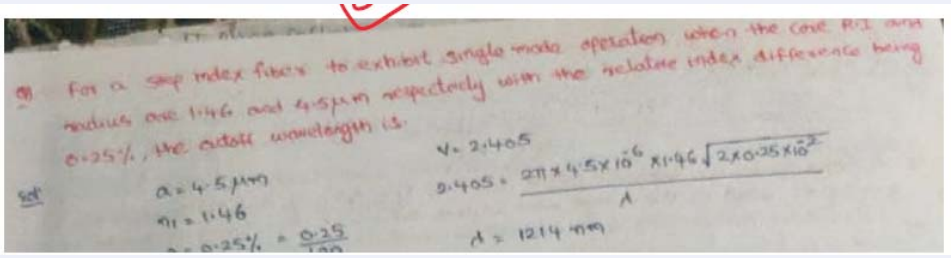
For single mode, $V = 2.405$

$$V = \frac{2\pi a}{\lambda} NA$$

$$\frac{V \times \lambda}{\pi \times NA} = 2a$$

$$2a = \frac{2.405 \times 820 \text{ nm}}{\pi \times 0.15}$$

$$\text{diameter} = 2a = 4.2 \text{ μm}$$



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End of Solution

Q.55 Consider the following statements:

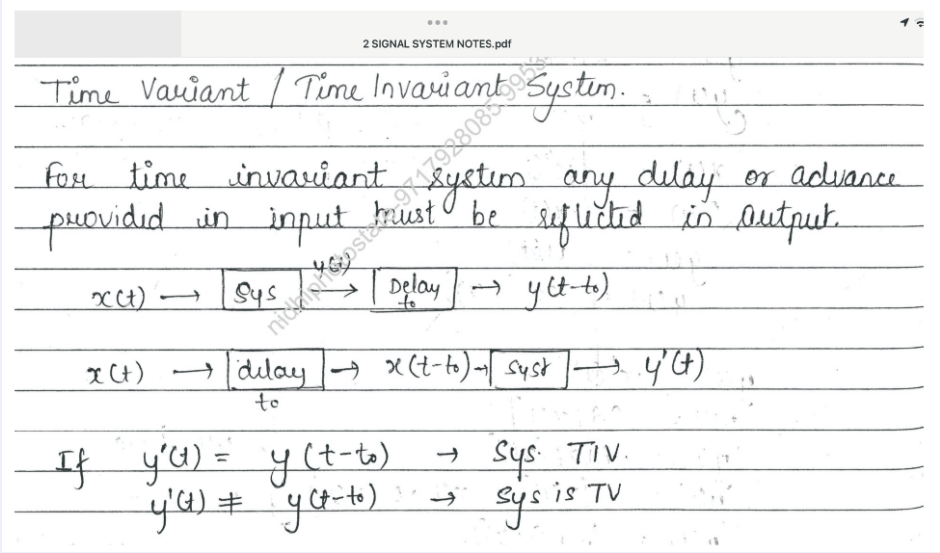
A time-invariant system is

1. also referred to equivalently as a shift-invariant system
2. a system for which a time shift or delay of the input sequence causes a corresponding shift in the output sequence

Which of the above statements is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans. (c)



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End of Solution

Q.56 Consider the following statements:

The Nyquist criteria

1. provide the theoretical basis for using the loop frequency response to determine the stability of a closed-loop system
2. may be used to assess stability from experimental data describing the system

Which of the above statements is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans. (a)

End of Solution

Q.57 Consider the following statements: Bode diagram is

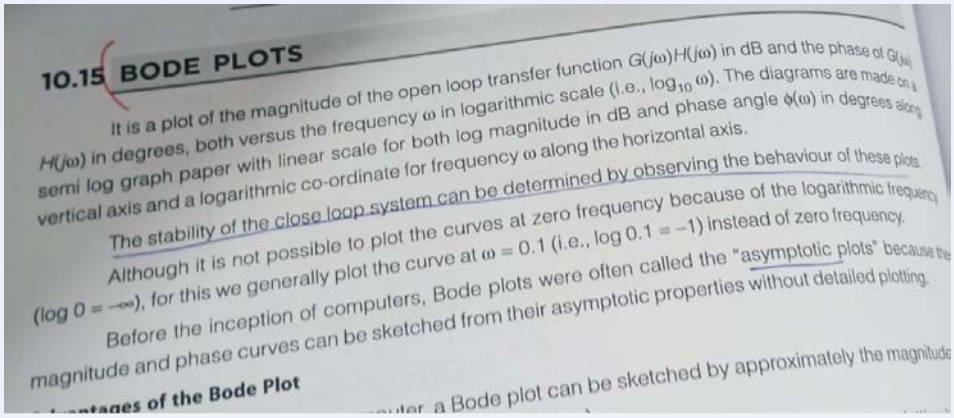
1. a method for studying the stability of a linear feedback system
2. useful in developing engineering intuition regarding the effect of pole-zero placement on the frequency response $L(j\omega)$

Which of the above statements is/are correct?

(a) 1 only (b) 2 only

(c) Both 1 and 2 (d) Neither 1 nor 2

Ans. (c)



10.15 BODE PLOTS

It is a plot of the magnitude of the open loop transfer function $G(j\omega)H(j\omega)$ in dB and the phase of $G(j\omega)H(j\omega)$ in degrees, both versus the frequency ω in logarithmic scale (i.e., $\log_{10}\omega$). The diagrams are made on a semi log graph paper with linear scale for both log magnitude in dB and phase angle $\phi(\omega)$ in degrees along vertical axis and a logarithmic co-ordinate for frequency ω along the horizontal axis.

The stability of the close loop system can be determined by observing the behaviour of these plots.

Although it is not possible to plot the curves at zero frequency because of the logarithmic frequency ($\log 0 = -\infty$), for this we generally plot the curve at $\omega = 0.1$ (i.e., $\log 0.1 = -1$) instead of zero frequency.

Before the inception of computers, Bode plots were often called the "asymptotic plots" because the magnitude and phase curves can be sketched from their asymptotic properties without detailed plotting.

...ntages of the Bode Plot

...puter, a Bode plot can be sketched by approximately the magnitude

MADE EASY Study Material

End of Solution

Q.58 A unit impulse function is defined as

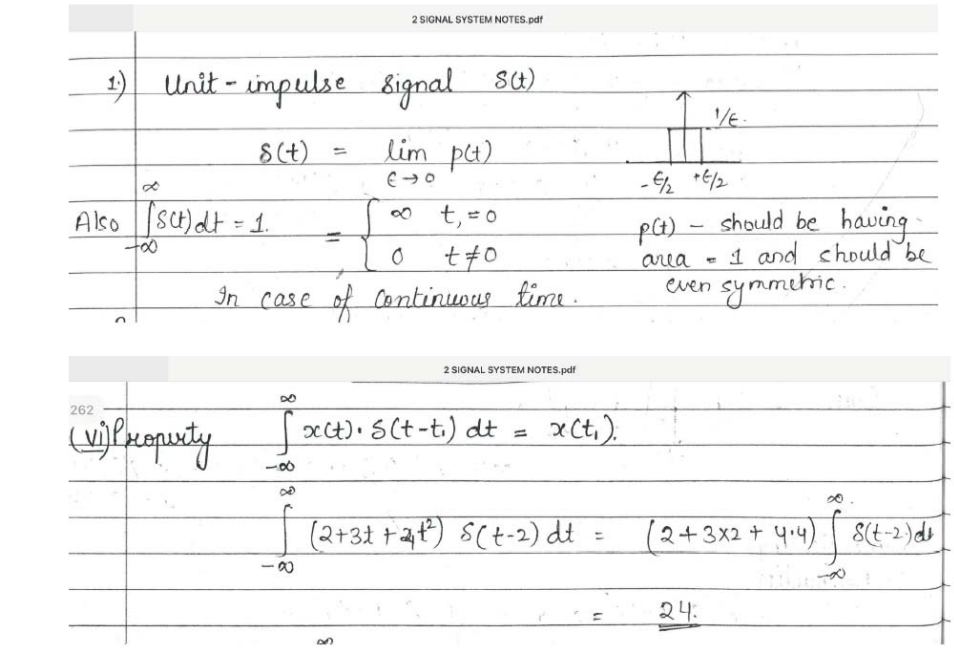
1. $\delta(t) = \begin{cases} 0 & \text{for } t \neq 0 \\ \infty & \text{for } t = 0 \end{cases}$
2. $\int_{-\infty}^{\infty} \delta(t)\,dt = 1$
3. $\int_{-\infty}^{\infty} \delta(t) f(t)\,dt = f(0)$

Which of the above are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans. (d)

58. (d) Reference : Class notes



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End of Solution

Q.59 Consider the characteristic equation

$$s^2 + s(2 + K) + 4K = 0.$$

The open-loop transfer function of the system G(s)H(s) is

(a) $\frac{K(s+2)}{s(s+4)}$ (b) $\frac{K(s+4)}{s(s+2)}$

(c) $\frac{K(s+4)}{(s+2)}$ (d) $\frac{K(s+2)}{(s+4)}$

Ans. (b)

Q.1 Consider the following open-loop transfer function:

$$G = \frac{K(s+2)}{(s+1)(s+4)}$$

The characteristic equation of the unity negative feedback will be

(a) $(s+1)(s+4) + K(s+2) = 0$

(b) $(s+2)(s+1) + K(s+4) = 0$

(c) $(s+1)(s-2) + K(s+4) = 0$

(d) $(s+2)(s+4) + K(s+1) = 0$

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End of Solution

Q.60 Which one of the following is not the correct property of signal flow graph?

(a) The signal flow graph is applicable to non-linear time-invariant systems

(b) The value of the variable at each node is equal to the algebraic sum of all signals entering at that node

(c) The signal gets multiplied by the branch gain when it travels along it

(d) The signal flow graph is not the unique property of the system

Ans. (a)

Basic Properties of SFG

The important properties of the SFG are as follows:

1. SFG applies only to linear systems.
2. The equations for which an SFG is drawn must be algebraic equations in the form of cause-and-effect.
3. Nodes are used to represent variables. Normally, the nodes are arranged from left to right, from input to output, following a succession of cause-and-effect relations through the system.
4. Signals travel along branches only in the direction described by the arrows of the branches.
5. The branch directing from node X_1 to X_2 represents the dependence of X_2 upon X_1, but not the reverse.

It should be noted that the signal flow graph approach and ... are specified by non-information. The advantages in signal flow graph method is that, using Mason's gain ... reduction techniques, the system can be computed easily. This method is simpler than that tedious block diagram

The signal flow graph depicts the flow of signals from one point of a system to another and gives the relationships among the signals. A signal flow graph consists of a network in which nodes are connected by directed branches. Each node represents a system variable and each branch connected between two nodes acts as a signal multiplier. Each branch has a gain or transmittance. When the signal pass through a branch, it gets multiplied by the gain of the branch. Note that the signal flows in only one direction. The direction of the signal flow is indicated by an arrow placed on the branch and the multiplication factor is indicated along the branch.

MADE EASY Study Material

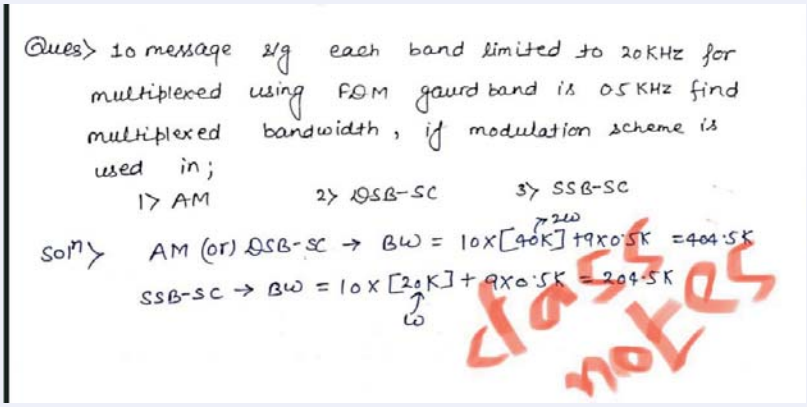
End of Solution

Q.61 Five channels, each with a 100 kHz bandwidth, are to be multiplexed together. If there is a need for a guard band of 10 kHz between the channels to prevent interference, the minimum bandwidth of the link will be

(a) 540 kHz (b) 510 kHz
(c) 470 kHz (d) 440 kHz

Ans. (a)

Number of channels (or) signals = 5
B.W of each channel = 100 kHz
Guard band = 10 kHz
Minimum B.W of the link = 5 × 100 kHz + (5 – 1) × 10 kHz
= 540 kHz



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End of Solution

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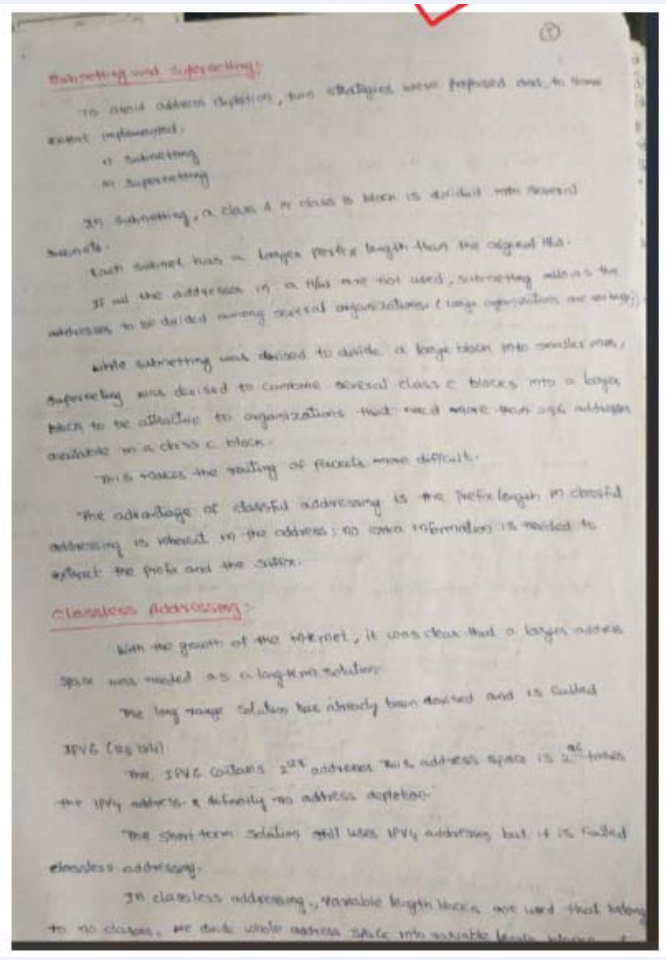
Q.62 The entries in a CIDR routing table contain 32-bit IP address and a 32-bit mask. The CIDR enables a technique called

(a) supernetting
(b) routing tables
(c) deployment of CIDR
(d) logical packet flows

Ans. (a)

CIDR = Classless Inter Domain Routing

Supernetting – It adds small networks to form a big network.



MADE EASY Class Notes

End of Solution

Q.63 The free space path loss L_p incurred by an electromagnetic wave is

(a) $\left(\frac{4\pi fD}{c}\right)^2$ (b) $\left(\frac{2\pi fD}{c}\right)^2$

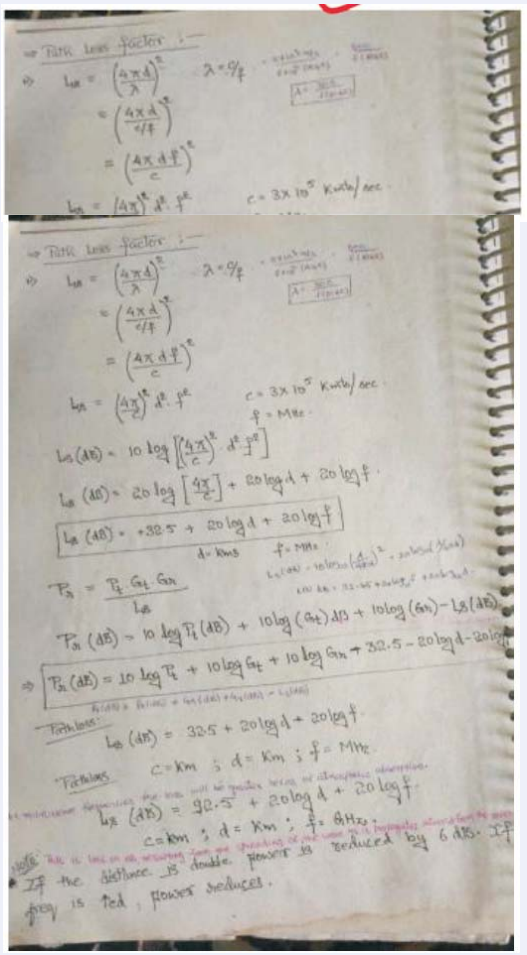
(c) $4\pi\left(\frac{fD}{c}\right)^2$ (d) $2\pi\left(\frac{fD}{c}\right)^2$

where, c is velocity of light in free space, f is frequency, D is distance

Ans. (a)

Free space path loss $L_p = \left(\frac{4\pi D}{\lambda}\right)^2 = \left(\frac{4\pi D}{c/f}\right)^2$

$$L_p = \left(\frac{4\pi fD}{c}\right)^2$$



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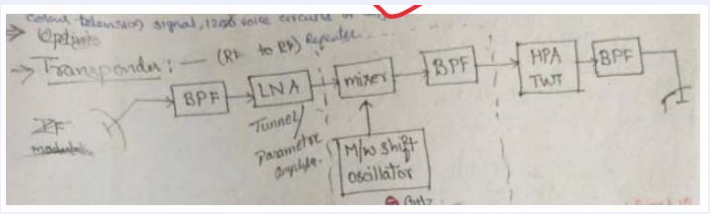
End of Solution

Q.64 Which one of the following amplifiers is widely used in transponders to provide the final output power required to the transmit antenna?

(a) Travelling-wave tube amplifier
(b) Power amplifier
(c) Two-stage wave tube amplifier
(d) Three-stage wave tube amplifier

Ans. (a)

Travelling-wave tube amplifier



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End of Solution

Q.65 Which one of the following systems of satellites is sometimes called 'Internet in the SKY'?

(a) Globalstar
(b) Teledesic
(c) Iridium
(d) Medium Earth Orbit (MEO)

Ans. (b)

Teledesic – which aims at providing broadband internet globally via a constellation of LEO satellites.

End of Solution

Q.66 A directional antenna with 10 dB gain radiates 500 watts. The receiving antenna at 15 km distance receives 2 microwatts. If there is negligible ground and ionospheric reflection, the effective area of the receiving antenna will be nearly

(a) 3.1 m^2 (b) 2.3 m^2

(c) 1.1 m^2 (d) 0.3 m^2

Ans. (c)

Given data, $G_d = 10 \text{ dB} = 10$

$P_{rad} = 500 \text{ W}$

$r = 15 \text{ km}$

$P_r = 2 \mu\text{w}$

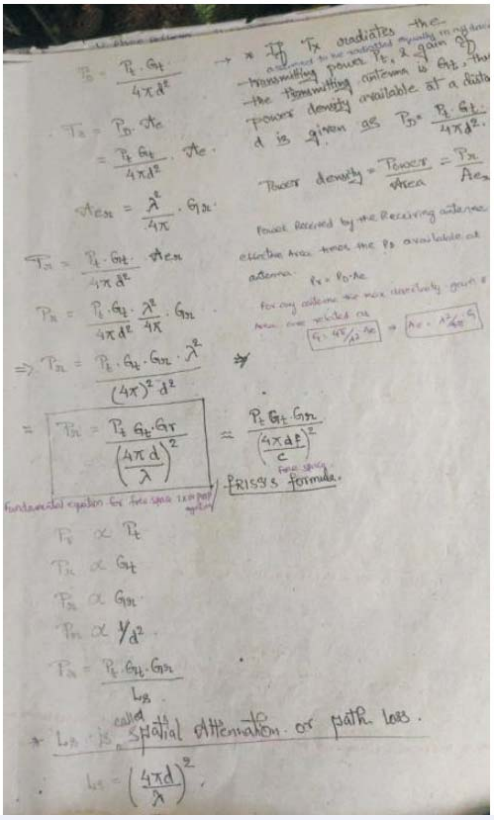
$A_e = ?$

$\because \quad A_e = \dfrac{P_r}{P_{avg}}$

$\therefore \quad P_r = 2 \mu\text{W}$ (given)

and $P_{avg} = \dfrac{P_{rad}}{4\pi r^2} G_d = \dfrac{500}{4\pi(15\times10^3)^2} \times 10 = 1.768 \mu\text{W}$

$\therefore \quad A_e = \dfrac{2\times10^{-6}}{1.768\times10^{-6}} = 1.13 \text{ m}^2$



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End of Solution

Q.67 The time used for all civil time keeping purposes, and is the time reference which is broadcast by the National Bureau of Standards as a standard for setting clocks, is

(a) Mean Time Coordinated
(b) Universal Time Coordinated
(c) Epoch Time Coordinated
(d) Real Time Coordinated

Ans. (b)

Coordinated universal time
UTC –Universal Time coordinated

End of Solution

Q.68 The point on the earth vertically below the satellite is referred to as the

(a) reference point
(b) meridian point
(c) apparent point
(d) sub-satellite point

Ans. (d)

The subsatellite point is the location on the earth's surface that lies directly beneath a satellite in orbit.

End of Solution

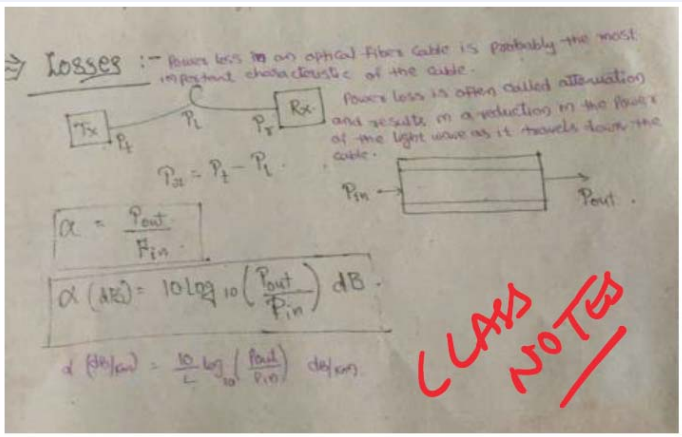
Q.69 The total reduction of power level in optical fiber cable, A(dB), is

(a) $25\log\frac{P_{out}}{P_{in}}$
(b) $20\log\frac{P_{out}}{P_{in}}$
(c) $15\log\frac{P_{out}}{P_{in}}$
(d) $10\log\frac{P_{out}}{P_{in}}$

where P_{in} is cable input power, P_{out} is cable output power

Ans. (d)

$$\text{Attenuation } (\alpha) = 10\log\left(\frac{P_{out}}{P_{in}}\right)$$



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End of Solution

Directions: Each of the following six (06) items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

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

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

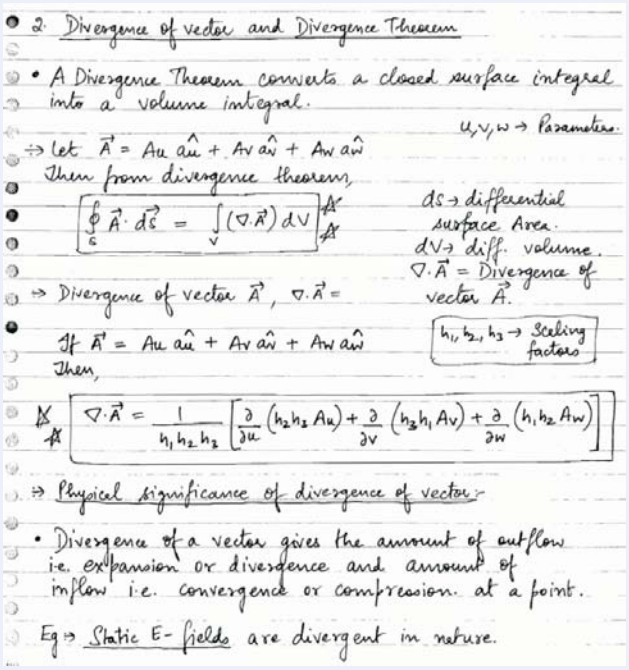
(c) Statement (I) is true but Statement (II) is false

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

Q.70 **Statement (I):** Stokes' theorem gives relation between a double integral and a single integral, and is applied only to an open surface.

Statement (II): Gauss' divergence theorem gives relation between a triple integral and a double integral, and is applied only to a closed surface.

Ans. (b)



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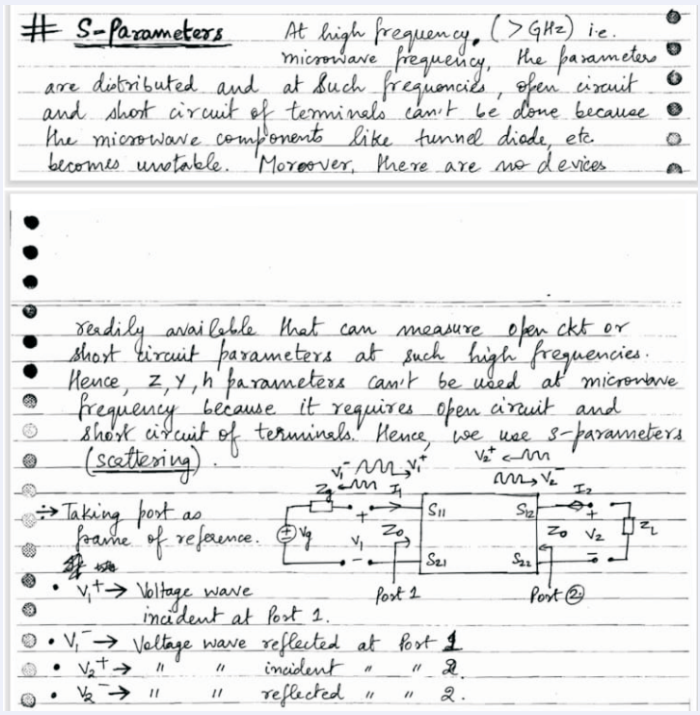
End of Solution

Q.71 **Statement (I):** The microwave junction can be defined as S-parameters or scattering parameters.

Statement (II): A scattering matrix is a square matrix which gives all the combinations of the power relationships between the various input and output ports of a microwave junction.

Ans. (a)



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End of Solution

Q.72 **Statement (I):** Electron lithography offers higher resolution than optical lithography.

Statement (II): Electron lithography has small wavelength of the 10-50 keV electrons.

Ans. (a)

Electron lithography offers higher resolution than optical lithography. This is because the shorter wavelength of electrons compared to UV light (typically ranges from 10 to 100 keV).

End of Solution

Q.73 **Statement (I):** In communication network, the element of the network should be designed such that maximum power transfer takes place between the source to the load.

Statement (II): The maximum power is absorbed by one network from another network, when the impedance of one is the complex conjugate of the other.

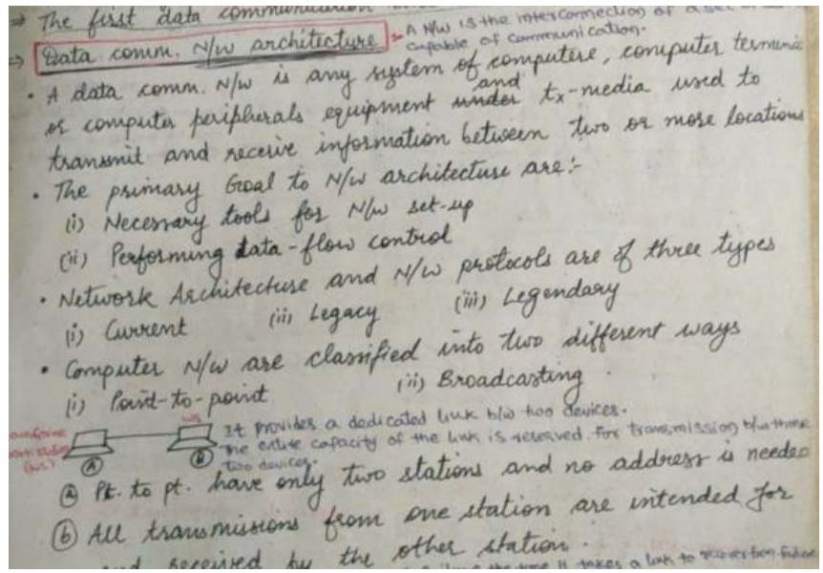
Ans. (a)

End of Solution

Q.74 **Statement (I):** A network is two or more devices connected together through links.

Statement (II): A link is a communication pathway that transfers data from one device to another.

Ans. (a)



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End of Solution

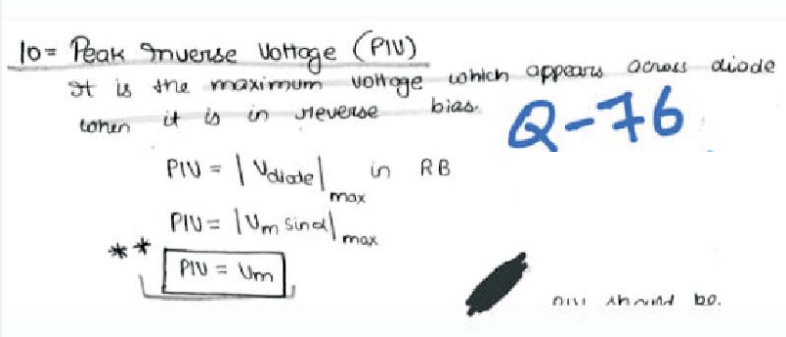
Q.75 **Statement (I):** Mode partition noise is a multiplicative noise in an optical fiber link.
Statement (II): Mode partition noise arises when the optical source emits several frequencies in a rapid succession.

Ans. (a)

End of Solution

76. Which one of the following is the maximum reverse voltage that can be applied to the P-N junction?
(a) Maximum forward voltage
(b) Peak inverse voltage
(c) Maximum average voltage
(d) Respective peak forward voltage

Ans. (b)
Maximum reverse voltage is peak inverse voltage.



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End of Solution

77. The common-base DC current gain of a transistor is 0.967. If the emitter current is 10 mA, the base current will be
(a) 0.53 mA
(b) 0.44 mA
(c) 0.33 mA
(d) 0.24 mA

Ans. (c)

$$\alpha = 0.967 \Rightarrow \beta = \frac{\alpha}{1-\alpha} = \frac{0.967}{1-0.967} = 29.3$$

$I_E = 10$ mA
$I_B = ?$
$I_E = I_B + I_C$
$= I_B + \beta I_B$
$I_E = (1 + \beta) I_B$

$$I_B = \frac{I_E}{1+\beta} = \frac{10\,\text{mA}}{1+29.3} = 0.33\,\text{mA}$$

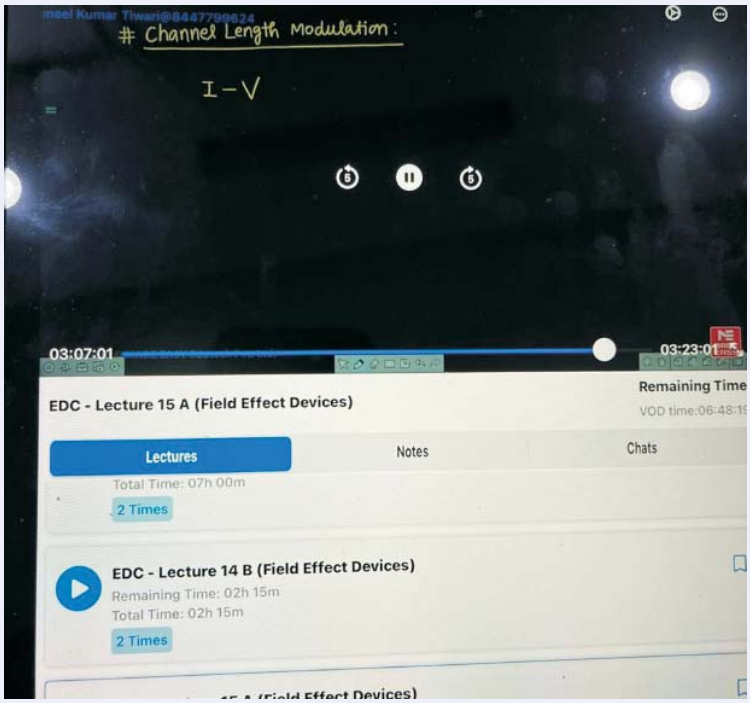
End of Solution

78. In actual MOSFET characteristic, a non-zero slope exists beyond the saturation point. For the saturation region, i.e., ($V_{DS} > V_{DS}$(sat)), the effective channel length decreases and this phenomenon is called

(a) base width modulation
(b) channel width modulation
(c) channel length modulation
(d) base length modulation

Ans. (c)

With increase in V_{DS}, effective channel length decreases, this is known as channel length modulation.



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End of Solution

79. MOSFETs have characteristics similar in form to those of JFETs. Hence MOSFETs are also known as

(a) Depletion MOSFETs (D-MOSFETs)
(b) Enhancement MOSFETs (E-MOSFETs)
(c) Insulated Gate Field Effect Transistors (IGFETs)
(d) *p*-channel MOSFETs

Ans. (a)

Depletion MOSFETs have characteristics similar to those of JFETs.

End of Solution

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80. A transistor has $\alpha = 0.995$ and if the base current is 200 μA, the value of the emitter current will be

(a) 30 mA (b) 35 mA
(c) 40 mA (d) 45 mA

Ans. (c)

$$\alpha = 0.995 \Rightarrow \beta = \frac{\alpha}{1-\alpha} = \frac{0.995}{1-0.995} = 199$$

$I_B = 200\ \mu A$
$I_E = (1 + \beta)I_B = (1 + 199) \times 200 \times 10^{-3}\ mA$
$I_E = 40\ mA$

End of Solution

81. A common-emitter transistor amplifier has an input impedance of 2 kΩ and a load resistance of 25 kΩ. If the β of the transistor is 100, the power gain will be

(a) 112500 (b) 125000
(c) 150000 (d) 175000

Ans. (b)

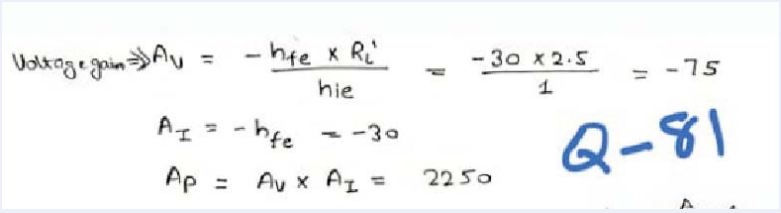
$Z_i = 2\ k\Omega$
$R_L = 25\ k\Omega$
$\beta = 100$

power gain, $P_V = A_V \cdot A_I$

For CE amplifier, $A_V = \frac{A_I R_L}{Z_i} = \frac{\beta R_L}{Z_i}$

$$= \frac{100 \times 25k}{2k} = 1250$$

$P_V = 1250 \times 100$
$= 125{,}000$



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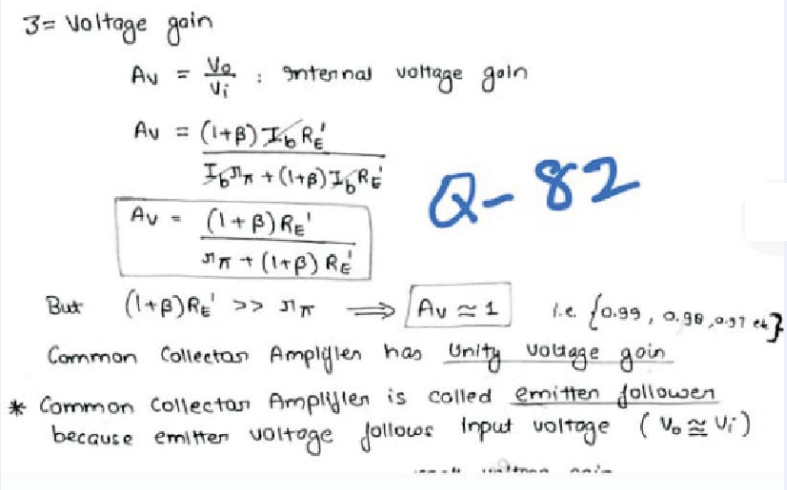
End of Solution

82. Which one of the following amplifiers is called an emitter follower?
(a) Common-emitter amplifier (b) Common-collector amplifier
(c) Common-base amplifier (d) Common-drain amplifier

Ans. (b)
Common collector amplifier is called emitter follower.



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End of Solution

83. Which one of the following is **not** the correct advantage of integrated circuits (ICs)?
(a) Low power consumption
(b) Very high reliability because failure rate becomes minimal as there is no exposed component
(c) There are no limitations of power and voltage rating
(d) Improved performance

Ans. (c)
There are no limitations of power and voltage rating (wrong statement)

End of Solution

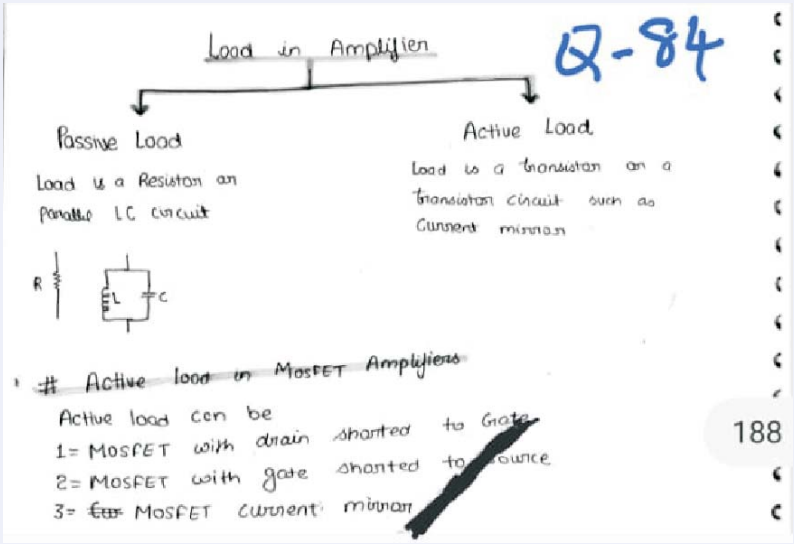
84. MOSFET, used as a load device, is referred to as

(a) critical load (b) dormant load

(c) active load (d) passive load

Ans. (c)

MOSFET as a load device is referred as active load.



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End of Solution

85. ICs in which circuits are fabricated, i.e., all the transistors in such circuits operate in cut-off and saturation regions, the adders, multiplexers, and comparators are

(a) digital ICs (b) linear ICs

(c) analog ICs (d) hybrid ICs

Ans. (a)

Digital ICs

End of Solution

86. For a non-inverting amplifier, the input resistor $R_1 = 1\,k\Omega$ and feedback resistor $R_f = 10\,k\Omega$. The closed-loop voltage gain A_f and feedback factor respectively are

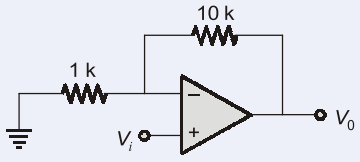
(a) 11 and 0.07 (b) 11 and 0.09

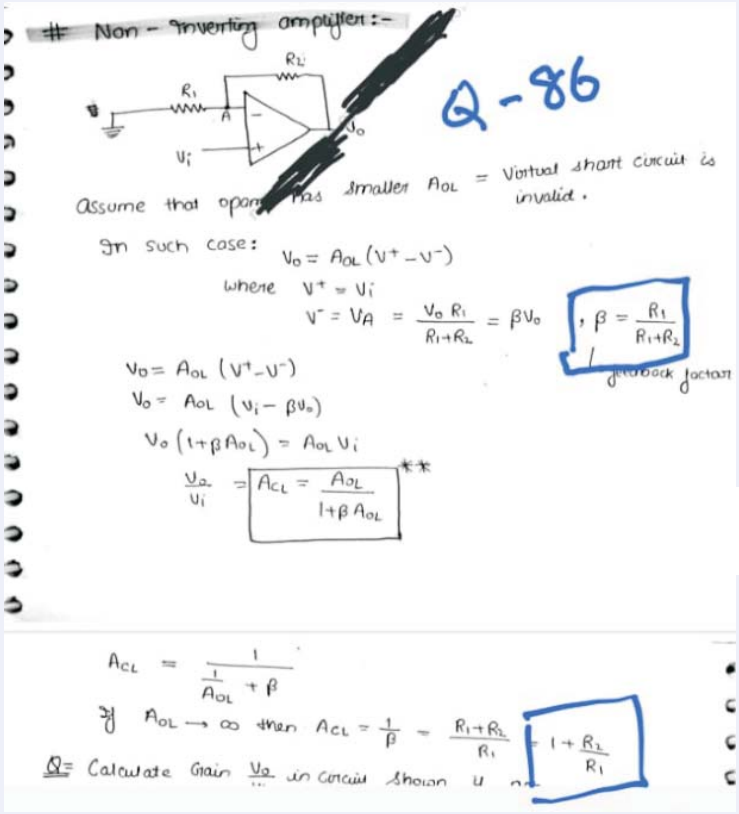
(c) 13 and 0.09 (d) 13 and 0.09

Ans. (b)

$$A_F = 1 + \frac{R_f}{R_1} = 1 + \frac{10k}{1k} = 11$$

$$\beta = \frac{1}{A_F} = \frac{1}{11} = 0.09$$





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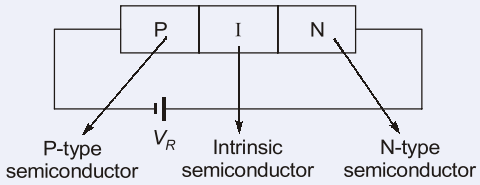
End of Solution

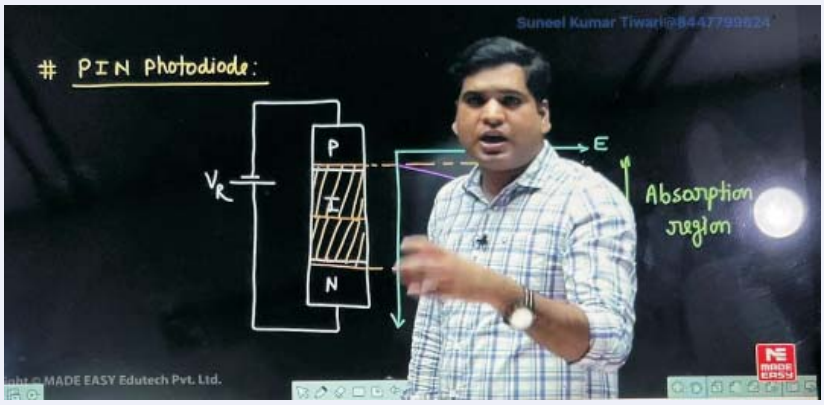
87. Which one of the following is a three-region reverse-biased junction diode?

(a) P-N junction diode
(b) Light-emitting diode
(c) PIN photodiode
(d) Zener diode

Ans. (c)

PIN photodiode has three regions as shown below and it is operated under reverse bias.





MADE EASY Class Lecture

End of Solution

88. Two resistances, one of 30 Ω and another of unknown value are connected in parallel; the total power dissipated in the circuit is 450 W, when the applied voltage is 90 volts. The value of the unknown resistance will be

(a) 35 Ω
(b) 40 Ω
(c) 45 Ω
(d) 50 Ω

Ans. (c)

Assume unknown resistance = R_2

Given that $R_1 = 30\ \Omega$

Power dissipated in a parallel circuit $\Rightarrow P = \dfrac{V^2}{R_{eq}}$

$$R_{eq} = \frac{90 \times 90}{450} = 18\ \Omega$$

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} \Rightarrow 18 = \frac{30 \times R_2}{30 + R_2} \Rightarrow 18 \times 30 + 18R_2 = 30R_2$$

$$12R_2 = 18 \times 30 \Rightarrow R_2 = 45\ \Omega$$

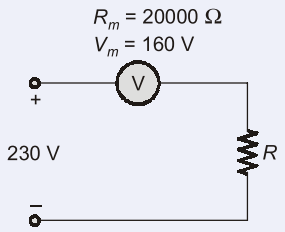
End of Solution

89. A voltmeter has a resistance of 20000 Ω. When connected in series with an external resistance across a 230 V supply, the instrument reads 160 V. The value of the external resistance will be

(a) 8750 Ω (b) 8560 Ω
(c) 8370 Ω (d) 8180 Ω

Ans. (a)

$R_m = 20000\ \Omega$
$V = 230\ V$
$V_m = 160\ V$



Using voltage division rule,

$$160 = 230\left[\frac{20000}{R+20000}\right]$$

$$R + 20000 = 28750$$

$$\Rightarrow \quad R = 8750\ \Omega$$

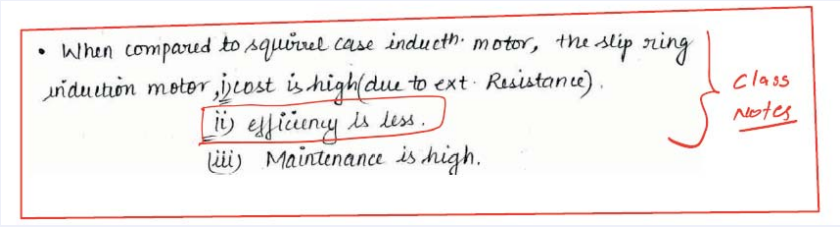
End of Solution

90. Which one of the following is **not** the correct advantage of wound-rotor (or slip-ring) induction motor?

(a) It has high starting torque with low starting current
(b) It has adjustable speed
(c) It has high overload capacity
(d) It has high efficiency as compared to squirrel-cage motor

Ans. (d)

Due to slip ring arrangement. Losses $\uparrow \Rightarrow \eta \downarrow$



MADE EASY Class Notes

End of Solution

91. An iron rod of 2 m length and 4 cm^2 cross-section is in the form of a closed ring. The permeability of the iron ring is 50×10^{-4} H-m^{-1}. To produce magnetic flux of 4×10^{-4} Wb, the required ampere-turns will be

(a) 200 A/m (b) 225 A/m

(c) 250 A/m (d) 275 A/m

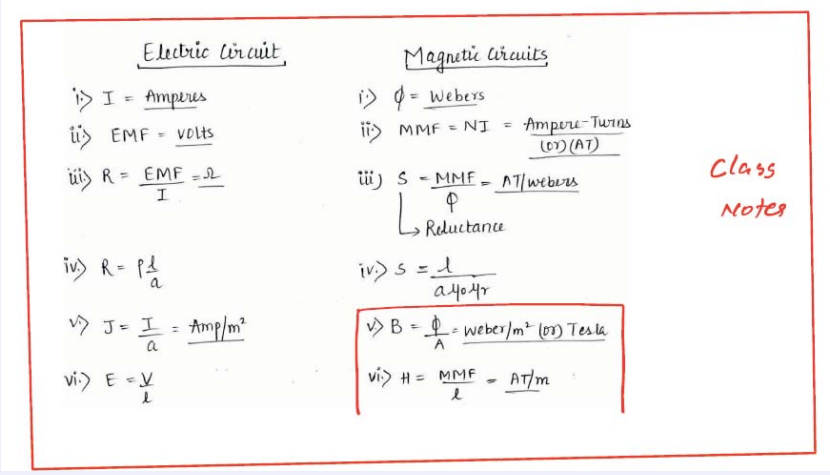
Ans. (a)

$$B = \frac{\phi}{A} = \frac{4\times10^{-4}}{4\times10^{-4}} = 1$$

$$B = \mu H$$

$$l = 50 \times 10^{-4} \text{ H}$$

$$H = \frac{B}{\mu} = \frac{1}{50\times10^{-4}} = 200 \text{ A/m}$$



MADE EASY Class Notes

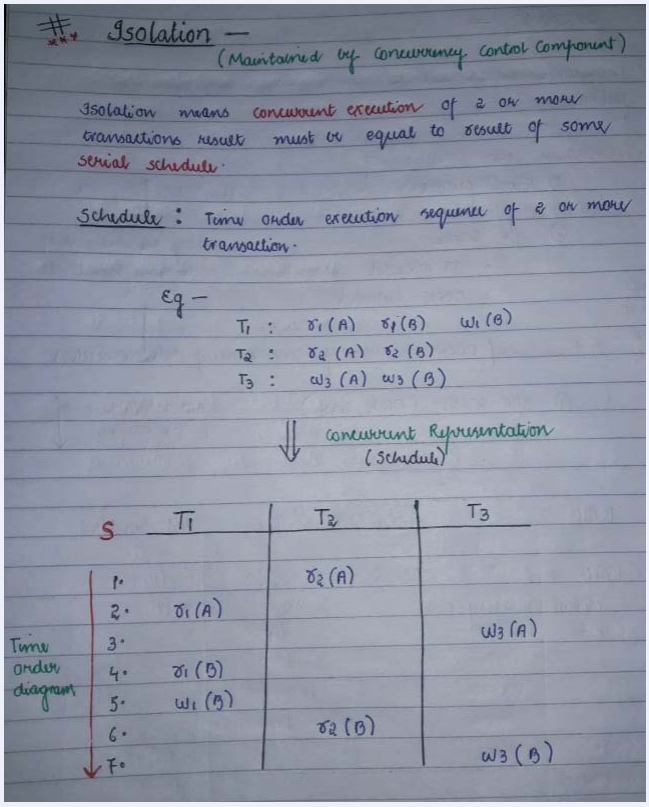
End of Solution

92. When transactions are executing concurrently in an interleaved fashion, then the order of execution of operations from the various transactions is known as

(a) schedule
(b) serializability
(c) concurrency
(d) controllable

Ans. (a)

Schedule/History is the interleaved sequence of operation forms a single-ordered view of how the transactions interact with the data base. This schedule is important for ensuring that the DB remains consistent and that the results of the transactions are correct.



MADE EASY Class Notes

End of Solution

93. Which one of the following is one of the most popular solutions processing for nanoparticles (mostly oxides) production?

(a) CVD technique
(b) Sol-gel technique
(c) Aerogel synthesis technique
(d) Co-precipitation technique

Ans. (b)

Sol-gel technique is the most popular solution-based processing methods, for producing nanoparticles, specially metal oxides like SiO_2, TiO_2 and Al_2O_3.

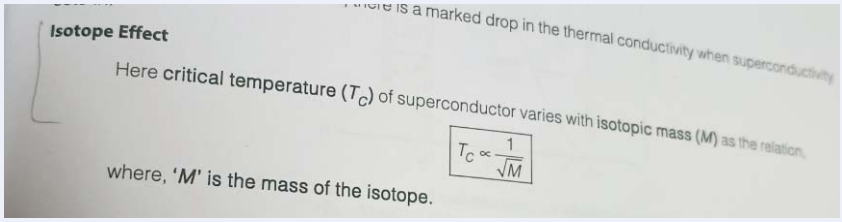
End of Solution

94. The transition temperature T_c of a superconductor varies with its isotopic mass M is

(a) $T_c \propto M^{-\frac{1}{2}}$
(b) $T_c \propto M^{\frac{1}{2}}$
(c) $T_c \propto M^{-2}$
(d) $T_c \propto M^{2}$

Ans. (a)

$$T_c \propto \frac{1}{\sqrt{M}} \Rightarrow T_c \propto M^{-1/2}$$


Isotope Effect

Here critical temperature (T_C) of superconductor varies with isotopic mass (M) as the relation,

$T_C \propto \frac{1}{\sqrt{M}}$

where, 'M' is the mass of the isotope.

MADE EASY Study Material

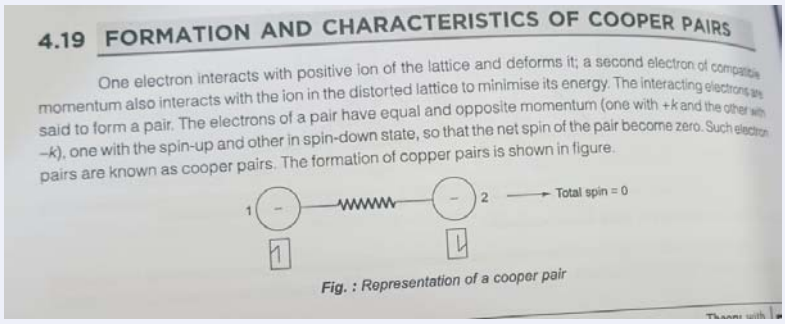
End of Solution

95. The 'Cooper pairing' is related to

(a) chemical vapour deposition
(b) thermal conductivity
(c) superconductivity
(d) flame pyrolysis

Ans. (c)

The Cooper pairing is related to superconductivity.


4.19 FORMATION AND CHARACTERISTICS OF COOPER PAIRS

One electron interacts with positive ion of the lattice and deforms it; a second electron of compatible momentum also interacts with the ion in the distorted lattice to minimise its energy. The interacting electrons are said to form a pair. The electrons of a pair have equal and opposite momentum (one with $+k$ and the other with $-k$), one with the spin-up and other in spin-down state, so that the net spin of the pair become zero. Such electron pairs are known as cooper pairs. The formation of copper pairs is shown in figure.

1 2 Total spin = 0

Fig. : Representation of a cooper pair

MADE EASY Study Material

End of Solution

96. For mercury of mass number 202, the value of α is 0.5 and T_c = 4.153 K. For the isotope of mercury of mass number 200, the transition temperature is nearly

(a) 3.4 K (b) 4.2 K

(c) 5.4 K (d) 6.2 K

Ans. (b)

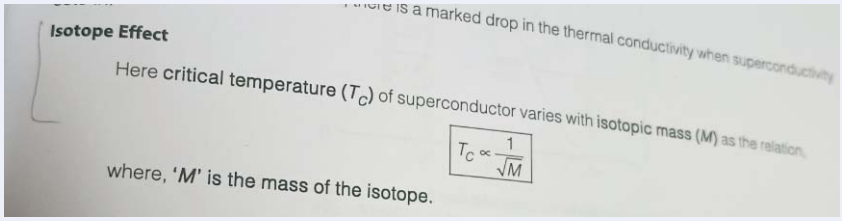
$$T_c \propto \frac{1}{\sqrt{M}}$$

$$\Rightarrow \quad \frac{T_{c2}}{T_{c1}} = \sqrt{\frac{M_1}{M_2}} \quad \Rightarrow \quad T_{c2} = \sqrt{\frac{M_1}{M_2}} \cdot T_{c1}$$

$$\Rightarrow \quad T_{c2} = \sqrt{\frac{202}{200}} = 4.153\,\text{K}$$

$$\Rightarrow \quad T_{c2} = 4.17\ \text{K}$$

$$\Rightarrow \quad T_{c2} \simeq 4.2\ \text{K}$$



MADE EASY Study Material

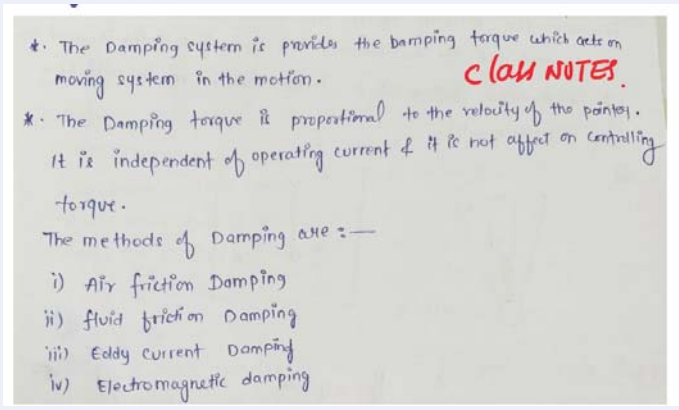
End of Solution

97. Which one of the following is **not** a correct method of obtaining damping?

(a) Air friction (b) Fluid friction

(c) Magnetic field (d) Eddy current

Ans. (c)



MADE EASY Class Notes

End of Solution

98. A 0–25 A ammeter has a guaranteed accuracy of 1% of full-scale reading. If the current measured by this instrument is 10 A, the limiting error will be

(a) 2.5% (b) 2.0%

(c) 1.5% (d) 1.25%

Ans. (a)

In 25A, 1% is $25 \times \frac{1}{100} \Rightarrow \pm 0.25$

$$\text{limiting error} = \frac{\text{absolute error}}{\text{measured value}} \times 100$$

$$= \frac{0.25}{10} \times 100 = 2.5\%$$

Work book

Q.8 An ammeter of range 0-25 A has a guaranteed accuracy of 1% of full-scale reading. The current measured by the ammeter is 5 A. The limiting error in the reading is

(a) 2% (b) 2.5%

(c) 4% (d) 5% [ESE-2000]

End of Solution

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99. The torque of an ammeter is directly proportional to the current flowing through it. A current of 10 A causes a deflection of 60°. When the instrument is spring-controlled, for a deflection of 40°, the value of the current will be nearly

(a) 6.7 A (b) 5.7 A

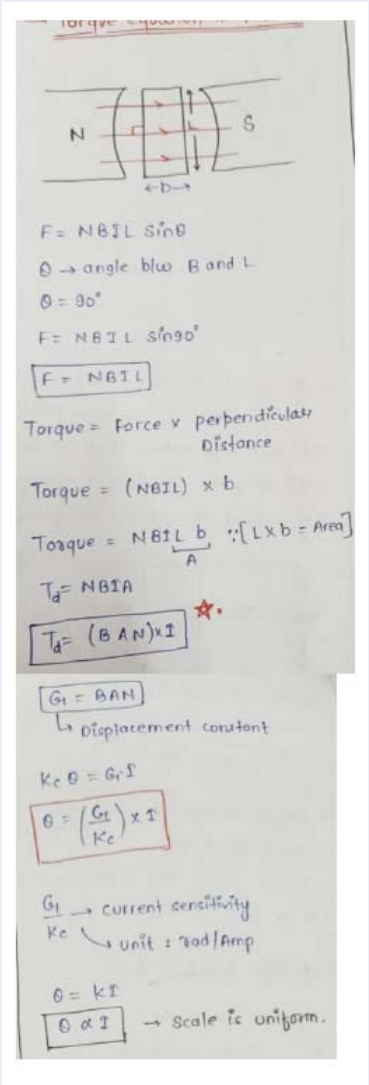
(c) 4.9 A (d) 3.9 A

Ans. **(a)**

Given that, $\theta \propto I;$

$$\Rightarrow \quad \frac{\theta_2}{\theta_1} = \frac{I_2}{I_1}$$

$$\frac{I_2}{10\ \text{A}} = \frac{40^\circ}{60^\circ} \Rightarrow I_2 = 6.7\ \text{A}$$

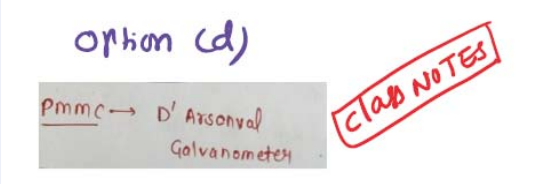


MADE EASY Class Notes

End of Solution

100. The basic Permanent Magnet Moving Coil (PMMC) instrument mechanism is often called
(a) electrodynamic movement (b) galvanometer movement
(c) iron vane movement (d) d'Arsonval movement

Ans. (d)
The basic Permanent Magnet Moving Coil (PMMC) instrument mechanism is often called as d'Arsonval movement.

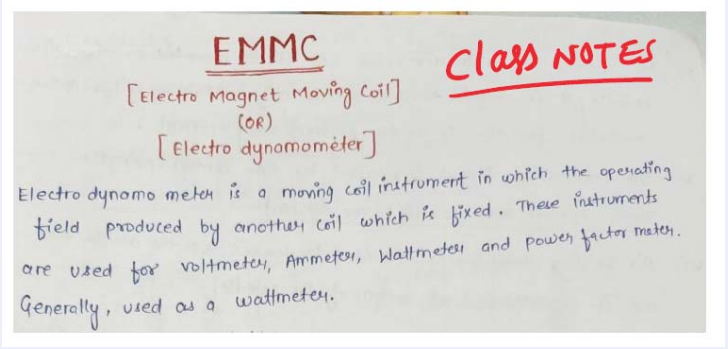


MADE EASY Class Notes

End of Solution

101. Which one of the following types of instruments will be used for AC measurements (current, voltage, power, and energy)?
(a) Moving iron (b) Moving coil permanent magnet
(c) Moving coil dynamometer (d) Induction

Ans. (d)
The instruments will be used for AC measurements (current, voltage, power, and energy) are Induction type instruments.



MADE EASY Class Notes

End of Solution

102. In a measurement system, if the force (across) is a measured variable, then its associated variable (power-based) will be
(a) translational displacement (b) translational acceleration
(c) translational velocity (d) rotational acceleration

Ans. (c)
In a measurement system, if the force (across) is a measured variable, then its associated variable (power-based) will be translational acceleration.

End of Solution

103. A coil with a resistance of 5 Ω is connected to the terminals of a Q-meter. Resonance occurs at an oscillator frequency of 8 MHz and resonating capacitance of 150 pF. What is the percentage error introduced by the insertion resistance of 0.1Ω?

(a) 4% (b) 3%

(c) 2% (d) 1%

Ans. (c)

Coil resistance, $R = 5\ \Omega$

Insertion resistance, $R_s = 0.1\ \Omega$

Resonating frequency, $f_r = 8$ MHz

Resonating capacitance, $C = 150$ pF

$$\text{at resonance} \Rightarrow X_L = X_C \Rightarrow X_L = \frac{1}{2\pi f_r C} = \frac{1}{2\pi \times 8 \times 10^6 \times 150 \times 10^{-12}}$$

$$X_L = 132.62\ \Omega$$

$$Q_{True} = \frac{X_L}{R} = \frac{132.6}{5} = 26.52$$

After inserting $R_s \Rightarrow R_{Total} = R + R_s = 5.1\ \Omega$

$$Q_{measured} = \frac{X_L}{R_{Total}} = \frac{132.6}{5.1} = 2.6$$

$$\%\text{Error} = \left(\frac{Q_m - Q_T}{Q_T}\right) \times 100 = \left(\frac{26 - 26.52}{26.52}\right) \times 100 \simeq 2\%$$

Q.39 In a Q-meter, a small resistance R_{SH} is added to the series resonance circuit to inject the oscillatory voltage to the circuit. If R is the apparent series resistance of the circuit at resonance, then the value of the actual Q will be equal to

(a) observed $Q \dfrac{1}{1+\dfrac{R}{R_{sh}}}$

(b) observed $Q\left(1+\dfrac{R}{R_{sh}}\right)$

(c) observed $Q \dfrac{1}{1+\dfrac{R_{sh}}{R}}$

(d) observed $Q\left(1+\dfrac{R_{sh}}{R}\right)$

[ESE-1998]

WorkBook

MADE EASY Study Material

End of Solution

104. The speed of a 6-pole induction motor supplied at 50 Hz is measured by a stroboscopic method. The neon lamp is supplied from the same source to which the induction motor is connected. The stroboscopic disc has 6 black and 6 white sectors. When the sector appears to be moving at 50 r.p.m., the speed of the induction motor will be

(a) 990 r.p.m. (b) 950 r.p.m.

(c) 890 r.p.m. (d) 840 r.p.m.

Ans. (b)

Given, $p = 6$

$f = 50$ Hz

Armature speed, $N_A = 50$ r.p.m

$$N_S = \frac{120f}{p} = \frac{120 \times 50}{6} = \frac{6000}{6} = 1000 \text{ r.p.m}$$

Speed of induction motor,

$$N_r = N_S \pm N_A$$

As Induction motor speed < Stator speed,

$$N_R = N_S - N_A$$
$$= 1000 - 50$$
$$= 950 \text{ rpm}$$

End of Solution

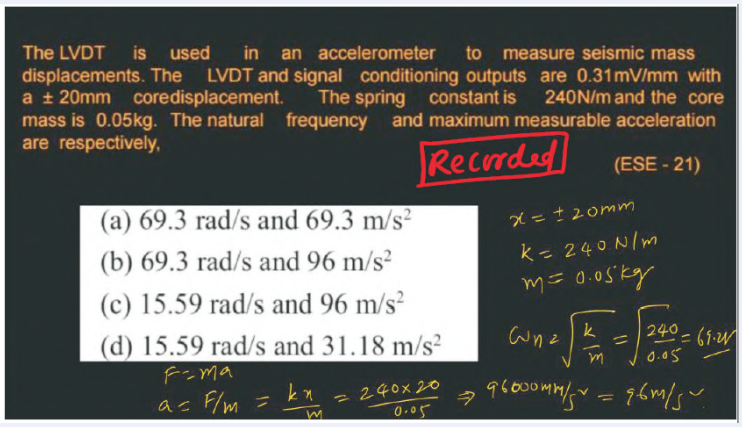
105. An accelerometer has a seismic mass of 0.06 kg and a spring constant of 4500 N/m. If the maximum mass displacement is ±0.025 m (before the mass hits the top), the maximum measurable acceleration will be

(a) 1675 m/s^2 (b) 1765 m/s^2
(c) 1875 m/s^2 (d) 1965 m/s^2

Ans. (c)

Given, $m = 0.06$ kg
$k = 4500$ N/m
$x = \pm 0.025$ m

We know that, Force = kx
$\Rightarrow$ Mass × acceleration = kx
$\Rightarrow$ $m \times a = kx$
$\Rightarrow$ $a = \dfrac{kx}{m} = \dfrac{4500 \times 0.025}{0.06}$
$\Rightarrow$ $a = 1875$ m/s^2



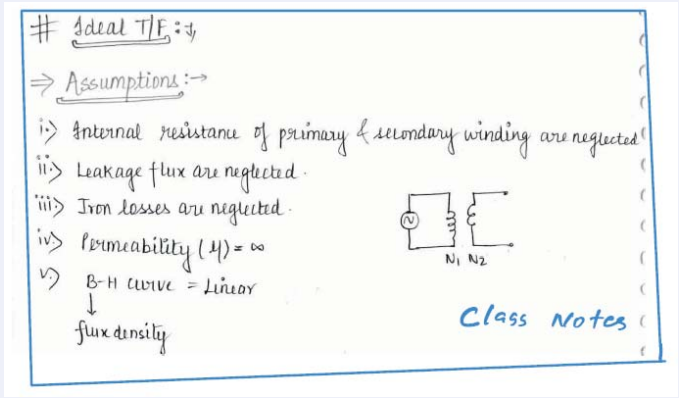
MADE EASY Class Lecture

End of Solution

106. Which one of the following statements is correct regarding an ideal transformer?
(a) The leakage flux is large.
(b) The transformer core losses are large.
(c) The transformer core material has infinite permeability.
(d) The transformer windings are with large resistances.

Ans. (c)

1. ideal transformer, $M \to \infty$, $I_m \to 0$
2. Leakage flux = 0
3. Iron loss, $P_{iron} = 0$
4. Cu Loss, $P_{cu} = 0$



MADE EASY Class Notes

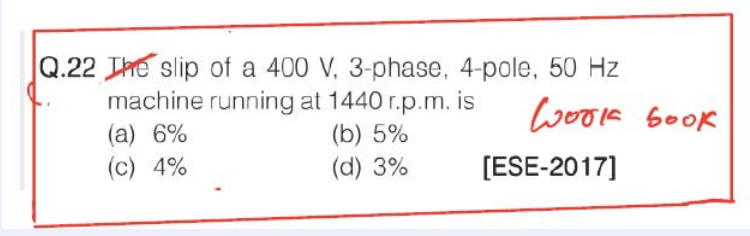
End of Solution

107. A 3-phase, 4-pole, 50 Hz induction motor is running at 1455 r.p.m. The value of the slip will be
(a) 2% (b) 3%
(c) 4% (d) 5%

Ans. (b)

$$N_S = \frac{120 \times 50}{4} = 1500 \text{ r.p.m}$$

$$S = \frac{1500 - 1455}{1500} \times 100 = 3\%$$



MADE EASY Study Material

End of Solution

108. The e.m.f. per turn of a single-phase, 10 kVA, 2200/220 V, 50 Hz transformer is 10 V. If the maximum flux density is 1.5 T, the net cross-sectional area of the core will be

(a) 0.01 m^2 (b) 0.02 m^2

(c) 0.03 m^2 (d) 0.04 m^2

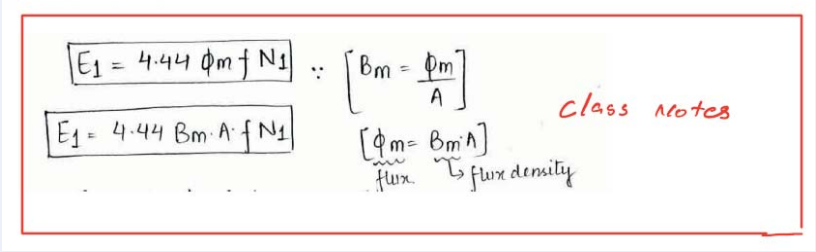
Ans. (c)

Given,

e.m.f per turn = 10 V = 4.44 $\phi_m f$ = 4.44 $(B_m\ ds)f$

net cross-sectional area of the core,

$$ds = \frac{10}{4.44 \times 1.5 \times 50} = 0.03\ m^2$$



MADE EASY Class Notes

End of Solution

109. A transformer rated 200/50 V, 10 kVA has a core loss of 100 W. If the full-load copper loss is 200 W and lagging power factor is 0.8, the load at maximum efficiency will be nearly

(a) 9 kVA (b) 7 kVA

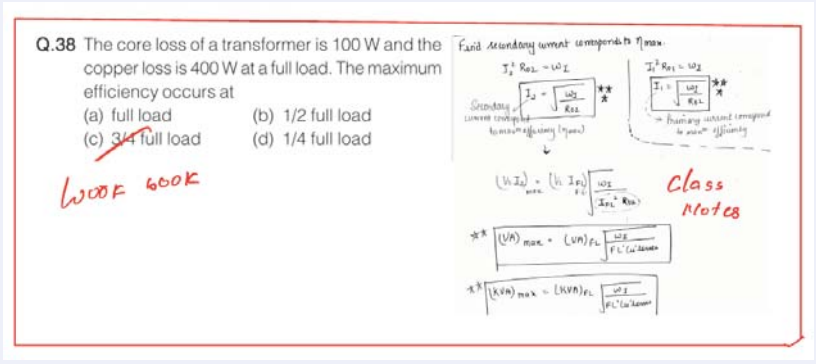
(c) 5 kVA (d) 3 kVA

Ans. (b)

at η_{max}, Variable loss = constant loss

x = fraction of load at η_{max} = $\sqrt{\frac{100}{200}} = 0.707$

$(kVA)_{\eta_{max}}$ = 0.707 × 10 ≈ 7 kVA



MADE EASY Study Material

End of Solution

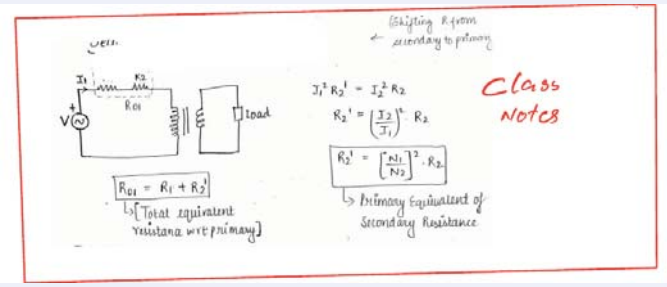
110. The impedance which transforms from one side of the ideal transformer to the other is in the direct

(a) square ratio of turns
(b) square root of ratio of turns
(c) ratio of turns
(d) square root of square ratio of turns

Ans. (a)

$$Z' = \frac{Z}{a^2} \text{ or } Z_b \times a^2$$

$$a = \frac{H.V.}{L.V.} = \frac{N_{H.V.}}{N_{L.V.}}$$



MADE EASY Class Notes

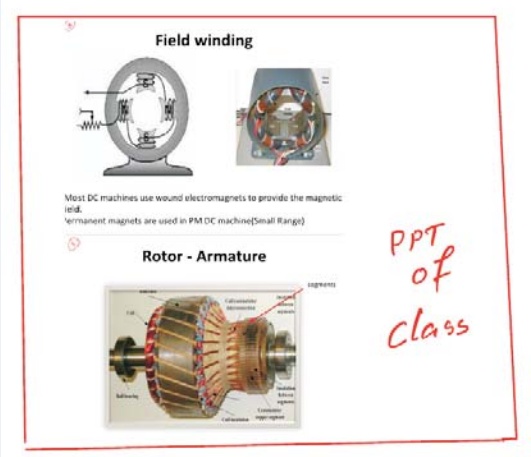
End of Solution

111. In which one of the following machines, the field poles are on the stator (and are DC excited) and the rotor constitutes the armature?

(a) Induction machine
(b) Elementary synchronous machine
(c) DC machine
(d) AC machine

Ans. (c)

In DC machines, armature on rotor.



MADE EASY Class Lecture

End of Solution

112. A 6-pole synchronous generator driven at 1000 r.p.m. feeds a 4-pole induction motor. If it is loaded to run at a slip of 4%, the motor speed will be

(a) 1360 r.p.m. (b) 1440 r.p.m.

(c) 1560 r.p.m. (d) 1640 r.p.m.

Ans. (b)

For Alternator

$$f = \frac{PN}{120} = \frac{6 \times 1000}{120} = 50\ \text{Hz}$$

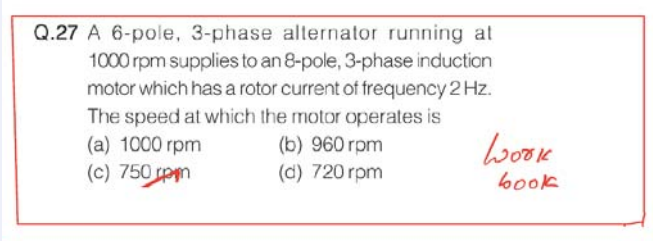
For Motor

$$N_s = \frac{120f}{P} = \frac{120(50)}{4} = 1500\ \text{r.p.m}$$

$$N = N_s[1 - s]$$

$$N = 1500[1 - 0.04]$$

$$N = 1440\ \text{r.p.m}$$


Q.27 A 6-pole, 3-phase alternator running at 1000 rpm supplies to an 8-pole, 3-phase induction motor which has a rotor current of frequency 2 Hz. The speed at which the motor operates is

(a) 1000 rpm (b) 960 rpm

(c) 750 rpm (d) 720 rpm

Wook Book

MADE EASY Study Material

End of Solution

113. An 8-pole, lap-wound, DC generator has 1000 armature conductors, a flux of 20 mWb per pole, and the e.m.f. generated is 200 V. What is the speed of the machine?

(a) 300 r.p.m. (b) 600 r.p.m.
(c) 900 r.p.m. (d) 1200 r.p.m.

Ans. (b)

Poles = 8, Lap-wound, $Z = 1000$

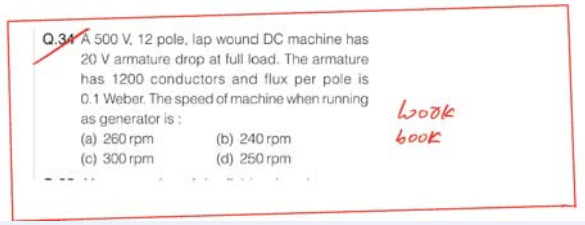
$$\phi = 20 \times 10^{-3}\ \text{Wb}, \qquad E_g = 200\ \text{V}$$

For Lap winding, $A = P$

$$E_g = \frac{\phi ZN}{60} \times \frac{P}{A}$$

$$200 = \frac{20 \times 10^{-3} \times 1000 \times N}{60} \times \frac{P}{A}$$

$$N = 600\ \text{r.p.m}$$


Q.34 A 500 V, 12 pole, lap wound DC machine has 20 V armature drop at full load. The armature has 1200 conductors and flux per pole is 0.1 Weber. The speed of machine when running as generator is :
(a) 260 rpm (b) 240 rpm
(c) 300 rpm (d) 250 rpm
600K
600K

MADE EASY Study Material

End of Solution

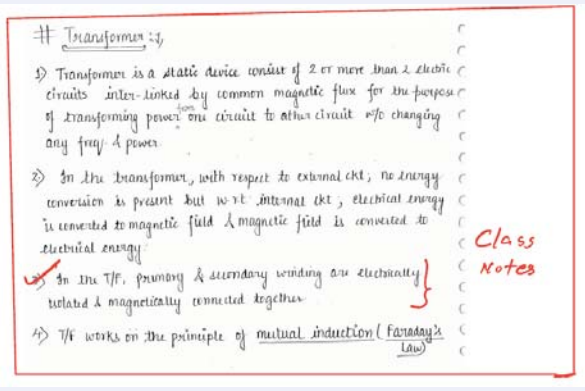
114. Consider the following statements regarding transformer:

1. It is a device that transfers electric power from one circuit to another.
2. In transformer, the two electric circuits are linked by mutual induction.

Which of the above statements is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Ans. (c)


Transformer :-
1) Transformer is a static device consist of 2 or more than 2 electric circuits inter-linked by common magnetic flux for the purpose of transforming power from one circuit to other circuit w/o changing any freq. & power.
2) In the transformer, with respect to external ckt, no energy conversion is present but w.r.t internal ckt, electrical energy is converted to magnetic field & magnetic field is converted to electrical energy.
3) In the T/F, primary & secondary winding are electrically isolated & magnetically connected together.
4) T/F works on the principle of mutual induction (Faraday's law)
Class Notes

MADE EASY Class Notes

End of Solution

115. Whenever a charged particle has an angular momentum, it will contribute to the permanent dipole moment. The following are the contributions to the angular momentum of an atom:
1. Orbital angular momentum of electron
2. Electron spin angular momentum
3. Nuclear spin angular momentum

Which of the above contributions to the angular momentum of an atom are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

Ans. (d)

In general there are three contributions to angular momentum of an atom–
1. Orbital electron angular momentum.
2. Electron spin angular momentum.
3. Nuclear spin angular momentum.

End of Solution

116. A substance of FCC lattice is having a molecular weight of 60.2 and density of 6250 kg/m^3. If the value of N is 6.02×10^{26}/kg-mole, the lattice constant will be

(a) 2 Å (b) 4 Å

(c) 6 Å (d) 8 Å

Ans. (b)

FCC $\rightarrow$ n = 4 atoms per unit cell

$V_c \rightarrow$ Volume of unit cell

$\rho \rightarrow$ density

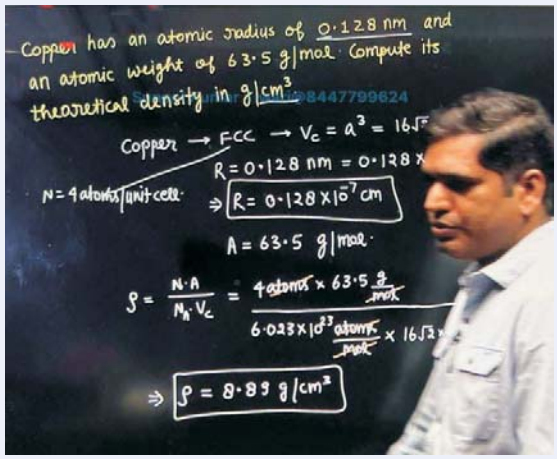
$N \rightarrow$ Avogadro's No.

$$\frac{n}{V_c} = \frac{N\rho}{A}$$

$$\Rightarrow \quad V_c = \frac{n.A}{N.\rho} = \frac{4 \times 60.2}{6.02 \times 10^{26} \times 6250} m^3$$

$$\Rightarrow \quad V_c = 6.4 \times 10^{-29} \text{ m}^3 = a^3$$

$$\Rightarrow \quad a = 4 \times 10^{-10} \text{ m} = 4 \text{ Å}$$



MADE EASY Class Lecture

End of Solution

117. Steatite is made from
(a) talc mixed with small quantity of clay and feldspar
(b) metal oxides and titanium dioxide
(c) aluminum dioxide
(d) barium titanate

Ans. (a)
Steatite is a ceramic material composed of talc with small additions of clay and feldspar to enhance its properties during firing. It is excellent electrical insulating material with high thermal resistance and low dielectric loss.

End of Solution

118. Which of the following are the important varieties of electrical mica?
(a) Muscovite mica and phlogopite mica
(b) Muscovite mica and pyrex mica
(c) Phlogopite mica and quartz mica
(d) Phlogopite mica and pyrex mica

Ans. (a)
Pyrex is not mica, it is a borosilicate glass.
Quartz mica is not a standard term in electrical insulation materials.

End of Solution

119. The dielectric strength of rubber is 40000 volts/mm at frequency 60 Hz. What is the thickness of insulation on a wire carrying 33 kV to sustain the breakdown?
(a) 0.64 mm (b) 0.72 mm
(c) 0.82 mm (d) 0.94 mm

Ans. (c)

$$\text{Dielectric strength} = \frac{\text{Breakdown voltage}}{\text{Thickness}}$$

$$\Rightarrow \quad \text{Thickness} = \frac{\text{Breakdown voltage}}{\text{Dielectric strength}} = \frac{33\times10^3 \text{ Volt}}{40000 \text{ Volt/mm}}$$

$$= 0.825 \text{ mm}$$

End of Solution

120. STM stands for
(a) Scanning Tunneling Microscope (b) Scientific Technical Microscope
(c) Scanning Technical Microscope (d) Scientific Tunneling Microscope

Ans. (a)

End of Solution

121. The turns ratio of a transformer used in a half-wave rectifier is $n_1 : n_2 = 12 : 1$. The primary is connected to the power mains 220 V, 50 Hz. If the diode resistance in forward bias is zero, the PIV of the diode will be nearly

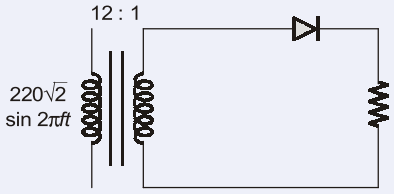
(a) 16 V (b) 19 V
(c) 22 V (d) 26 V

Ans. (d)

$$\frac{220\sqrt{2}}{V_s} : 1 = 12 : 1$$

$$V_s = \frac{220\sqrt{2}}{12} = 26 \text{ V}$$

$$\text{PIV} = 26 \text{ V}$$



MADE EASY Class Notes

End of Solution

122. FET amplifiers are introduced at the initial stages of receivers to make

(a) the final output less noisy (b) the bandwidth very large
(c) the gain very large (d) the output impedance very low

Ans. (a)

FET has less noise because it is unipolar.

End of Solution

123. A JFET has $V_P = -4.5$ V, $I_{DSS} = 10$ mA, and $I_{DS} = 2.5$ mA. The transconductance will be nearly

(a) 3.2 mA/V (b) 2.8 mA/V

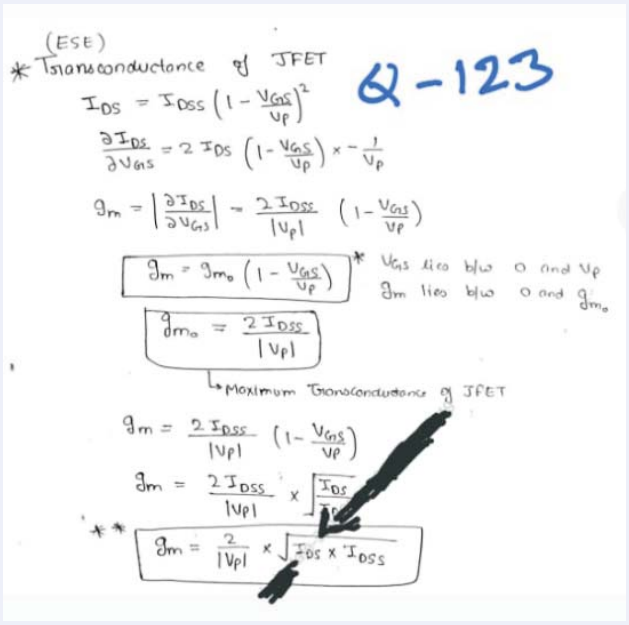
(c) 2.2 mA/V (d) 1.8 mA/V

Ans. (c)

$$g_m = \frac{-2}{V_P}\sqrt{I_D I_{DSS}}$$

$$= \frac{-2}{-4.5\text{ V}}\sqrt{2.5\text{ mA} \times 10\text{ mA}}$$

$$= \frac{2}{4.5} \times 5 = 2.2\text{ mA/V}$$



MADE EASY Class Notes

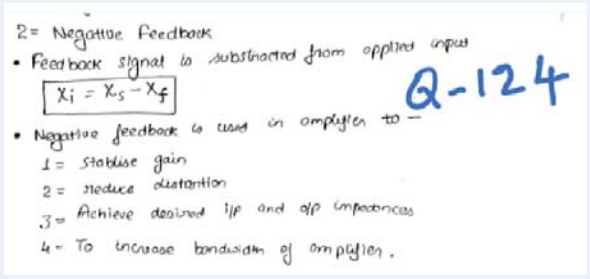
End of Solution

124. Which one of the following is **not** the correct advantage of negative feedback in amplifiers?

(a) Less harmonic distortion
(b) Reduced noise
(c) Highly stabilized gain
(d) Decreased bandwidth

Ans. (d)

Negative feedback increases bandwidth.



MADE EASY Class Notes

End of Solution

125. The advantage of the dual-slope ADC is its

(a) high sensitivity to noise and to variations in its component values caused by pressure changes
(b) low sensitivity to noise and to variations in its component values caused by pressure changes
(c) high sensitivity to noise and to variations in its component values caused by temperature changes
(d) low sensitivity to noise and to variations in its component values caused by temperature changes

Ans. (d)

Low sensitivity to noise and to variations in its component values caused by temperature changes.

End of Solution

126. Consider the following Boolean expression:

$f = A\bar{B}C + B + B\bar{D} + AB\bar{D} + \bar{A}C$

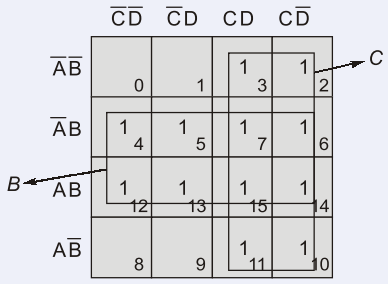
The simplified expression will be

(a) A + B (b) B + C

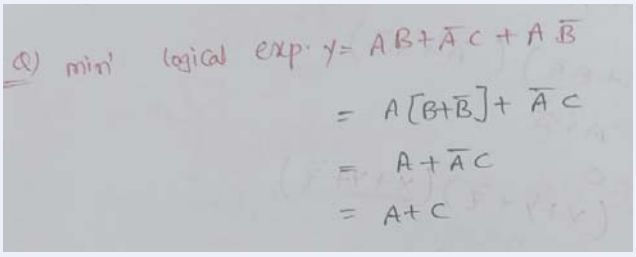
(c) C + D (d) A + D

Ans. (b)

$f = A\bar{B}C + B + B\bar{D} + AB\bar{D} + \bar{A}C$



$\therefore$ $f = B + C$



MADE EASY Class Notes

End of Solution

127. What is the result of Excess-3 (XS-3) addition of numbers 9 and 5?

(a) 11 (b) 12

(c) 13 (d) 14

Ans. (a)

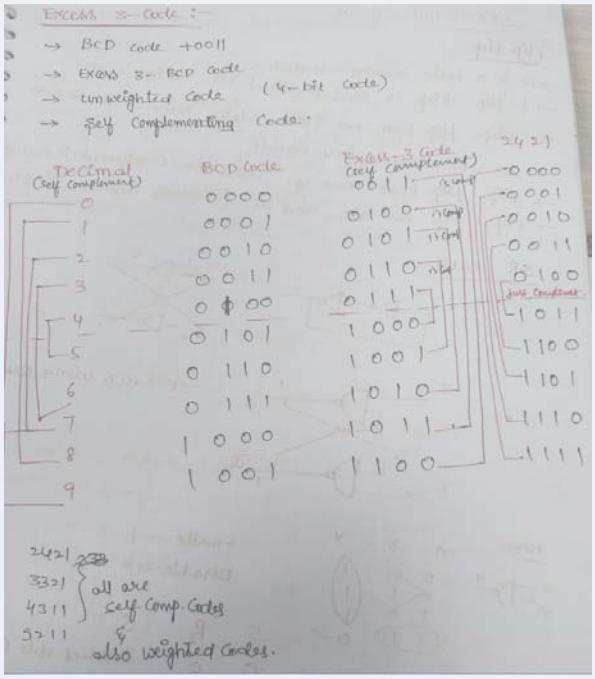
Given, Excess-3 numbers

$9 \longrightarrow (6)_{10} \longrightarrow (0110)_2$

$5 \longrightarrow (2)_{10} \longrightarrow (0010)_2$

$(6)_{10} + (2)_{10} = (8)_{10}$

$\therefore$ Excess-3 sum = 8 + 3 = 11



MADE EASY Class Notes

End of Solution

128. The network that couples the output signal voltage of a stage to the input of the next stage of a multi-stage amplifier is called

(a) biasing network (b) resistive network

(c) feedback network (d) coupling network

Ans. (d)

End of Solution

129. The expression

$f = (B + BC)(B + \bar{B}C)(B + D)$

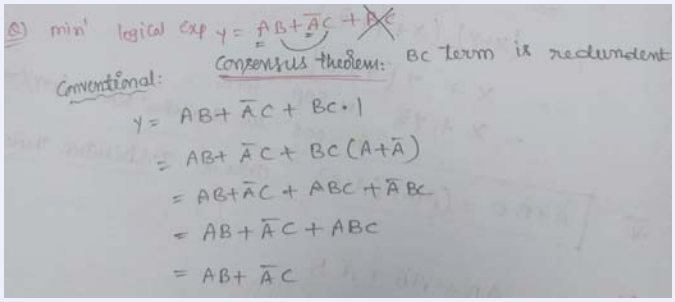
after reduction is equivalent to

(a) $\bar{B}$ (b) B

(c) C (d) D

Ans. (b)

$$\begin{aligned} f &= [B + BC][B + \bar{B}C][B + D] \\ &= B[1 + BC][B + \bar{B}C][B + D] \\ &= B[B + \bar{B}C][B + D] \\ &= [BB + \bar{B}BC][B + D] \\ &= [B + 0][B + D] \\ &= BB + BD = B + BD \\ &= B[1 + D] \\ &= B \end{aligned}$$



MADE EASY Class Notes

End of Solution

MADE EASY students top in ESE 2024

• 4 Streams 4 Toppers all 4 MADE EASY Students • 40 out of 40, in Top 10 • 197 out of total 206 Vacancies (95% Selections)

CE 10 in Top 10

AIR	Name	Course
1	ROHIT DHONDGE	CLASSROOM COURSE
2	HARSHIT PANDEY	CLASSROOM COURSE
3	LAXMIKANT	CLASSROOM COURSE
4	D MADHANKUMAR	CLASSROOM COURSE
5	AMAN PRATAP SINGH	CLASSROOM COURSE
6	SANCHIT GOEL	CLASSROOM COURSE
7	SUNIL SEERVI	CLASSROOM COURSE
8	ROHIT KUMAR	CLASSROOM COURSE
9	ANKIT MEENA	TEST SERIES & IGP
10	BADUGU RAJESH	ONLINE COURSE

ME 10 in Top 10

AIR	Name	Course
1	MUNISH KUMAR	TEST SERIES & IGP
2	RAJESH KASANIYA	ONLINE COURSE
3	GOLLANGI SATEESH	TEST SERIES & IGP
4	D. AJINKYA RADHAKISAN	CLASSROOM COURSE
5	BANKURU NAVEEN	CLASSROOM COURSE
6	CHANDAN JOSHI	ONLINE COURSE
7	DINESH KR. SHARMA	CLASSROOM COURSE
8	SHAILENDRA SINGH	CLASSROOM COURSE
9	KRISHNA K. DWIVEDI	CLASSROOM COURSE
10	V. AKSHAY SANTOSH	IGP

EE 10 in Top 10

AIR	Name	Course
1	RAJAN KUMAR	CLASSROOM COURSE
2	SATYAM CH. KHAIRNAR	CLASSROOM COURSE
3	PRIYANSHU MUDGAL	ONLINE COURSE
4	NAMAN AGARWAL	ONLINE COURSE
5	MAYANK KUMAR SINGH	CLASSROOM COURSE
6	RITVIK KOK	ONLINE COURSE
7	MANTHAN SHARMA	CLASSROOM COURSE
8	MAYANK JAIMAN	ONLINE COURSE
9	ANMOL SINGH	ONLINE COURSE
10	AKSHIT PARASHARI	ONLINE COURSE

E&T 10 in Top 10

AIR	Name	Course
1	HIMANSHU THAPLIYAL	CLASSROOM COURSE
2	YASHASVI VIJAYVARGIYA	CLASSROOM COURSE
3	UNNATI CHANSORIA	ONLINE COURSE
4	RAJIV RANJAN MISHRA	CLASSROOM COURSE
5	PARAG SAROHA	ONLINE COURSE
6	CHANDRIKA GADGIL	CLASSROOM COURSE
7	DEBARGHYA CHATTERJEE	CLASSROOM COURSE
8	VIDHU SHREE	ONLINE COURSE
9	T. PIYUSH DAYANAND	CLASSROOM COURSE
10	RAJVARDHAN SHARMA	CLASSROOM COURSE

MADE EASY students top in GATE 2025

• 10 All India Rank 1 (CE, ME, IN, ES & EE) • 46 Selections in Top 10 • 401 Selections in Top 100

CE 10 in Top 10

AIR	Name	Course
CE 1	ABHAY SINGH	CLASSROOM COURSE
CE 2	HARSHVARDHAN SINGH	CLASSROOM COURSE
CE 3	PANKAJ MEENA	CLASSROOM COURSE
CE 4	HARSHIL MAHESHWARI	ONLINE COURSE
CE 5	KARTIK POKHRIYAL	CLASSROOM COURSE
CE 6	SHIVANAND CHAURASIA	ONLINE COURSE
CE 6	NIMISH UPADHYAY	ONLINE COURSE
CE 9	TARUN YADAV	CLASSROOM COURSE
CE 10	ADNAN QUASAIN	CLASSROOM COURSE
CE 10	RAHUL SINGH	ONLINE COURSE

ME+PI 14 in Top 10

AIR	Name	Course
ME 1	RAJNEESH BIJARNIYA	CLASSROOM COURSE
ME 2	GOLLANGI SATEESH	ONLINE COURSE
ME 3	NIMESH CHANDRA	CLASSROOM COURSE
PI 3	ADITYA KUMAR PRASAD	CLASSROOM COURSE
PI 5	KULDEEP SINGH NARUKA	CLASSROOM COURSE
PI 6	KAUSHAL KUMAR KAUSHIK	ONLINE COURSE
PI 7	WALEED SHAIKH	TEST SERIES
ME 7	ABHINN	CLASSROOM COURSE
ME 8	GOUTAM KUMAR	TEST SERIES
ME 10	ASHUTOSH KUMAR	CLASSROOM COURSE
ME 10	JETTI GANATEJA	TEST SERIES
ME 10	MUHAMMED SINAN K	TEST SERIES
ME 10	PITCHIKA KUMAR VASU	ONLINE COURSE
PI 10	M GOPU GANESH	TEST SERIES

EE+CS 6 in Top 10

AIR	Name	Course
EE 1	PRADIP CHAUHAN	TEST SERIES
EE 2	KAILASH GOYAL	CLASSROOM COURSE
EE 6	PUNEET SONI	TEST SERIES
EE 6	SHIVAM KUMAR GUPTA	TEST SERIES
CS 9	OMHARI	TEST SERIES
EE 10	NEELAVA MUKHERJEE	POSTAL PACKAGE & TEST SERIES

IN+EC 9 in Top 10

AIR	Name	Course
IN 1	KAILASH GOYAL	CLASSROOM COURSE
EC 2	ANKUSH PHILIP JOHN	POSTAL PACKAGE & TEST SERIES
IN 2	S. BHATTACHARYA	TEST SERIES
IN 5	SACHIN YADAV	TEST SERIES
EC 5	M. M. NAFEEZ	TEST SERIES
EC 6	PENTELA BHAVANI	TEST SERIES
IN 6	UTKARSH PATIL	CLASSROOM COURSE
IN 7	DEV J. PATEL	TEST SERIES
EC 9	CHILUKURI S. CHARAN	TEST SERIES

ES+XE 7 in Top 10

AIR	Name	Course
ES 1	YASH JAIN	CLASSROOM COURSE
ES 2	JITESH CHOUDHARY	CLASSROOM COURSE
ES 2	TARUN YADAV	CLASSROOM COURSE
XE 3	ROHAN KUMAR BISWAL	TEST SERIES
ES 5	SACHIN KUMAR	CLASSROOM COURSE
ES 7	ANKIT KUMAR	CLASSROOM COURSE
XE 9	APAR HARSH CHANDRA	CLASSROOM COURSE

For complete results of ESE & GATE, visit : www.madeeasy.in

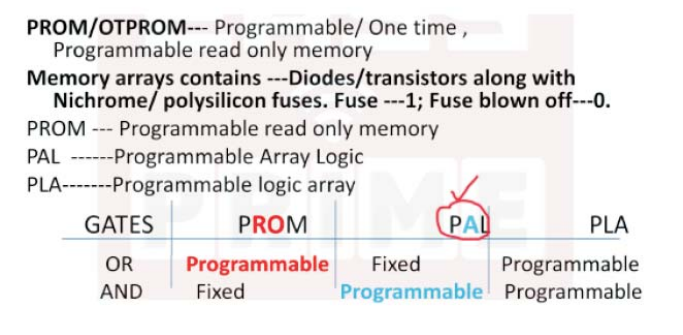
130. PAL is the programmable logic device with a fixed OR array and a programmable AND array. Because only the AND gates are
(a) non-programmable, the PAL is easier to program than, but it is not as flexible as the PLA
(b) programmable, the PAL is not easier to program than, but it is flexible as the PLA
(c) non-programmable, the PAL is not easier to program than, but it is flexible as the PLA
(d) programmable, the PAL is easier to program than, but it is not as flexible as the PLA

Ans. (d)

PAL → Programmable Array logic

		PROM	PAL	PLA
Gates	*OR*	Programmable	Fixed	Programmable
	AND	Fixed	Programmable	Programmable

PLA → Complex to design but flexible for programming AND and OR gates.



MADE EASY Class Lecture

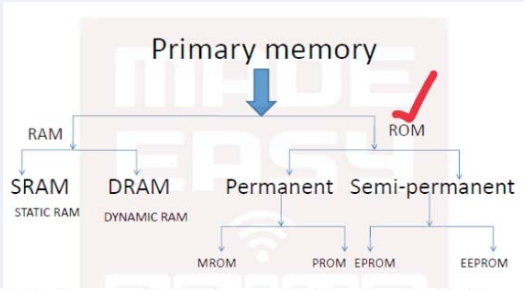
End of Solution

131. ROM is a
(a) non-volatile memory
(b) volatile memory
(c) read/write memory
(d) byte-organized memory

Ans. (a)

ROM → Read only memory

It is non-volatile memory.



ROM –Read only memory or Non-Volatile memory, the data can be retrieved for later use. Where as RAM is volatile and depends on Power supply.

MADE EASY Class Lecture

End of Solution

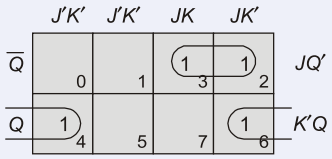
132. The characteristic equation of J-K flip-flop is

(a) $Q_{n+1} = \bar{Q}_n J + Q_n \bar{K}$ (b) $Q_{n+1} = \bar{Q}_n J - Q_n \bar{K}$

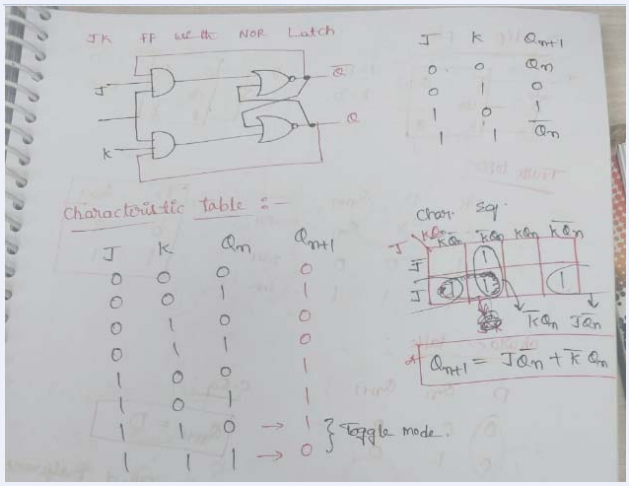
(c) $Q_{n+1} = \bar{Q}_n K + Q_n J$ (d) $Q_{n+1} = \bar{Q}_n K - Q_n J$

Ans. (a)

	$\bar{Q}$	J	K	Q	
0	0	0	0	0	NC
1	0	0	1	0	Reset
2	0	1	0	1	Set
3	0	1	1	1	$\bar{Q}$ Toggle
4	1	0	0	1	NC
5	1	0	1	0	Reset
6	1	1	0	1	Set
7	1	1	1	0	$\bar{Q}$ Toggle



$$Q^+ = J\bar{Q} + \bar{K}Q$$



MADE EASY Class Lecture

End of Solution

133. Which one of the following noise bandwidths is the bandwidth of that ideal bandpass system which produces the same noise power as the actual system?

(a) Equivalent noise bandwidth
(b) Linear noise bandwidth
(c) Actual noise bandwidth
(d) Generalized noise bandwidth

Ans. (a)

Equivalent Noise Bandwidth is the bandwidth of an idealized filter that produces the same amount of noise power as an actual system when both are exposed to white noise.

End of Solution

134. If an audio signal $s(t) = 3\cos(2\pi\ 500t)$ is quantized using 10-bit PCM, the signal-to-quantization noise ratio will be nearly

(a) 0.6×10^6
(b) 1.2×10^6
(c) 1.6×10^6
(d) 2.2×10^6

Ans. (c)

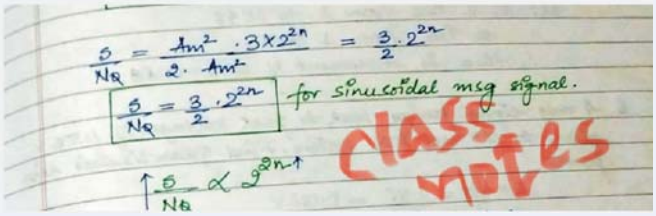
Given message signal $\rightarrow s(t) = 3\cos(2\pi\ 500t)$

$$n = 10$$

$$\frac{S}{N_q} = \frac{3}{2} \times 2^{2n}$$

$$= \frac{3}{2} \times 2^{20} = 1.5 \times 2^{20}$$

$$= 1.57 \times 10^6 \simeq 1.6 \times 10^6$$



MADE EASY Class Lecture

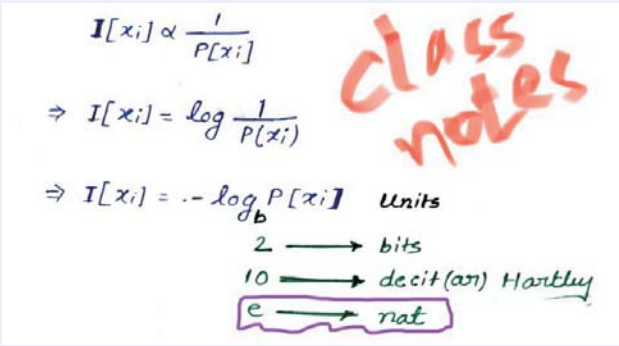
End of Solution

135. In information probability, when the base is 2, the unit is a bit, and when the base is '*e*', the unit is a

(a) 'bit' (b) 'decit'

(c) 'hartley' (d) 'nat'

Ans. (d)



MADE EASY Class Lecture

End of Solution

136. The deflection sensitivity of a CRT is 0.5 mm/V and an unknown voltage applied to the horizontal deflection plates shifts the spot by 5 mm towards the right in the horizontal direction. The unknown applied voltage will be

(a) 100 V (b) 125 V

(c) 150 V (d) 200 V

Ans. (a)

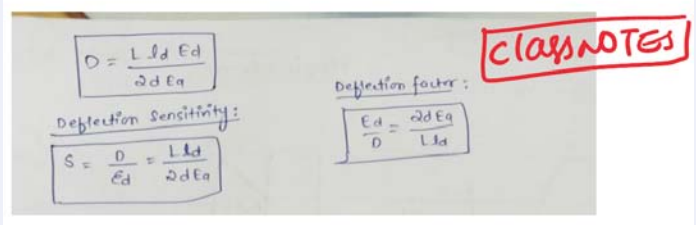
Given that sensitivity of CRT,

$$S = 0.05 \frac{\text{mm}}{\text{Volt}}$$

$$\text{Applied voltage } (V_d) = \frac{\text{Deflection } (D)}{\text{Deflection sensitivity } (S)}$$

$$V_d = \frac{D}{S} = \frac{5\text{ mm}}{0.05 \frac{\text{mm}}{\text{volt}}} = 100 \text{ Volt}$$

Applied voltage, $V_d = 100$ Volt



MADE EASY Class Lecture

End of Solution

137. A capacitive transducer with its plate separation of 0.05 mm under static conditions has a capacitance of 5×10^{-12} F. For causing a change of capacitance of 0.75×10^{-12} F, the displacement will be nearly

(a) 0.22 mm (b) 0.33 mm
(c) 0.42 mm (d) 0.53 mm

Ans. (b)

$$C = \frac{\varepsilon A}{x}$$

$$\varepsilon A = Cx \quad \ldots(1)$$

$$C' = \frac{\varepsilon A}{x'}$$

$$\varepsilon A = C'x \quad \ldots(2)$$

$$\frac{\text{eq. (1)}}{\text{eq. (2)}} = \frac{\varepsilon A}{\varepsilon A} = \frac{Cx}{C'x'}$$

$$1 = \frac{5 \times 10^{-12} \times 0.05}{0.75 \times 10^{-12} \times x'}$$

$$x' = 0.33 \text{ mm}$$

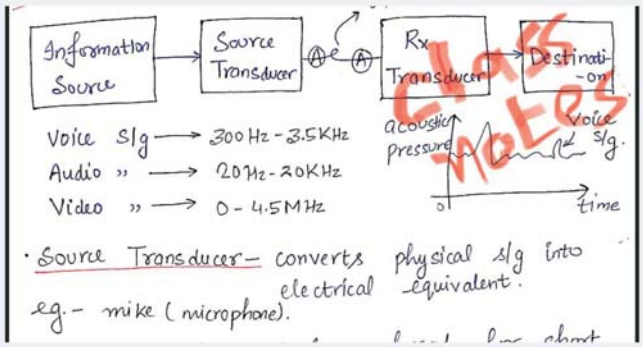
End of Solution

138. The input for most of the instrumentation systems is non-electrical. This is converted into an electrical signal by a device called

(a) rectifier (b) oscillator
(c) amplifier (d) transducer

Ans. (d)

Transducer is used to convert mechanical energy into electrical energy and vice-versa.



MADE EASY Class Lecture

End of Solution

139. Which of the following statements are correct?

1. Cut-off matrix provides a compact and effective means of writing algebraic equations giving branch voltages in terms of tree branches.
2. In cut-set matrix, the number of independent node-pair terminals is equal to the number of tree branches.
3. Tie-set matrix is used to find the branch currents.

Select the correct answer.

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans. (d)

End of Solution

140. Which of the following statements are correct?

1. The end points of a line segment on the junction between two or more branches or the end points of an isolated branch are called nodes.
2. If a sub-graph consists of an ordered sequence of branches, traversing from one node to another, this particular sub-graph is known as path.
3. The closed contour selected in a graph is known as loop.

Select the correct answer.

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans. (d)

End of Solution

141. Which of the following statements are correct?

1. A connected sub-graph of a connected graph having all the nodes of a graph without any loop is known as a tree.
2. The branches of the tree are known as twigs.
3. The branches that are removed from the tree are termed links.

Select the correct answer.

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2, and 3

Ans. (d)

End of Solution

142. Consider a reduced incidence matrix of a graph:

$$[A]=\begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \end{bmatrix}$$

The number of possible trees will be

(a) 16
(b) 24
(c) 26
(d) 28

Ans. (a)

$$[A]_a = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \\ 0 & 0 & 0 & +1 & +1 & -1 \end{bmatrix}_{4\times 6} \end{array}$$

Total number of possible trees $= N^{N-2}$

$= 4^{4-2} = 16$

where N = Number of Nodes

End of Solution

143. The Laplace transform of a function $f(t)$ is defined by

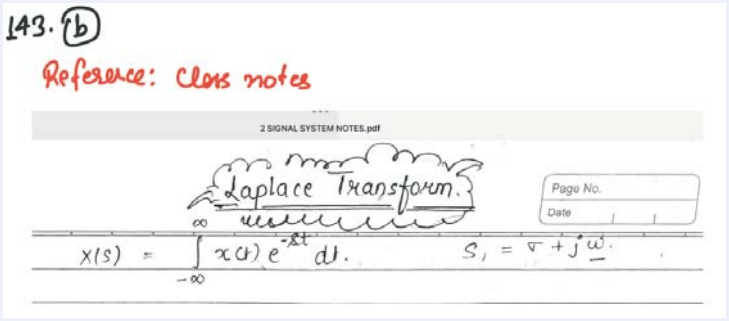
$$L\{f(t)\} = F(s) = \int_0^{\infty} f(t)e^{-st}dt$$

where s is a complex variable given by

(a) $\sigma - j\omega$ (b) $\sigma + j\omega$

(c) $\sigma / j\omega$ (d) $j\omega / \sigma$

Ans. (b)



MADE EASY Class Lecture

End of Solution

144. In an induction type energy meter, normally the flux due to shunt magnet does not lag the supply voltage exactly by 90°. The reason being that the shunt coil has some resistance. Due to this, the angle of phase is less than 90°, as a result, the torque on the disc is not zero at zero power factor. This type of error is called

(a) speed error
(b) creeping
(c) phase error
(d) torque error

Ans. (c)

Q.32 In a single phase induction type energy meter, the lag adjustment is done to ensure that
(a) Current coil flux lags the applied voltage by 90°
(b) Pressure coil flux lags the applied voltage by 90°
(c) Pressure coil flux in phase with applied voltage
(d) Current coil flux lags the pressure coil flux by 90° [ESE-2000]

WORK BOOK

MADE EASY Study Material

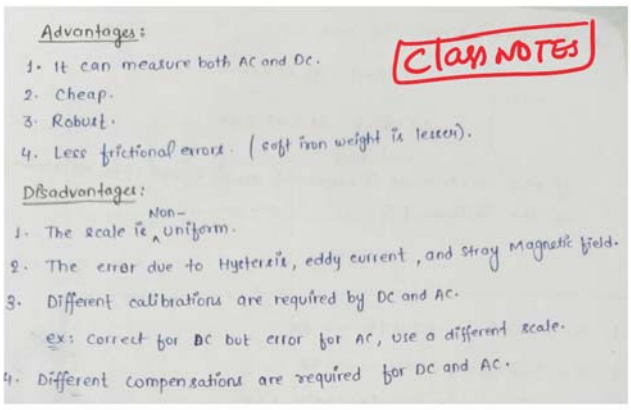
End of Solution

145. Which one of the following statements is **not** correct regarding moving iron instruments?

(a) These instruments possess high operating torque.
(b) In these instruments, power consumption is higher for low voltage ranges.
(c) These instruments are capable of giving accuracy within the limits of both precision and industrial grades.
(d) Scales of these instruments are uniform.

Ans. (d)

Moving iron instrument has low operating torque.



CLASS NOTES

MADE EASY Class Notes

End of Solution

146. If the *z*-parameters for a network are $z_{11} = 42\ \Omega$, $z_{22} = 35\ \Omega$, $z_{12} = 25\ \Omega$, and $z_{21} = 25\ \Omega$, then the parameters *A*, *B*, *C*, and *D* are respectively

(a) 1.68, 33.8 Ω, 0.04 mho, 1.4 (b) 2.68, 33.8 Ω, 0.04 mho, 0.4

(c) 1.68, 13.8 Ω, 0.14 mho, 1.4 (d) 2.68, 13.8 Ω, 0.14 mho, 0.4

Ans. (a)

$V_1 = Z_{11}I_1 + Z_{12}I_2$ ...(1) | $V_1 = AV_2 - BI_2$ ...(3)

$V_2 = Z_{21}I_1 + Z_{22}I_2$ ...(2) | $I_1 = CV_2 - DI_2$ ...(4)

From eq. (2)

$$I_1 = \frac{V_2}{Z_{21}} - \frac{Z_{22}}{Z_{21}} I_2 \qquad ...(5)$$

Compare eq. (4) and eq. (5)

$$C = \frac{1}{Z_{21}} = \frac{1}{25} = 0.04\ \text{℧}, \quad D = \frac{Z_{22}}{Z_{21}} = \frac{35}{25} = 1.4$$

Substitute eq. (5) in eq. (1)

$$V_1 = \frac{Z_{11}}{Z_{21}} V_2 + \left(Z_{12} - \frac{Z_{11}Z_{22}}{Z_{21}} \right) I_2 \qquad ...(6)$$

Compare eq. (3) and eq. (6)

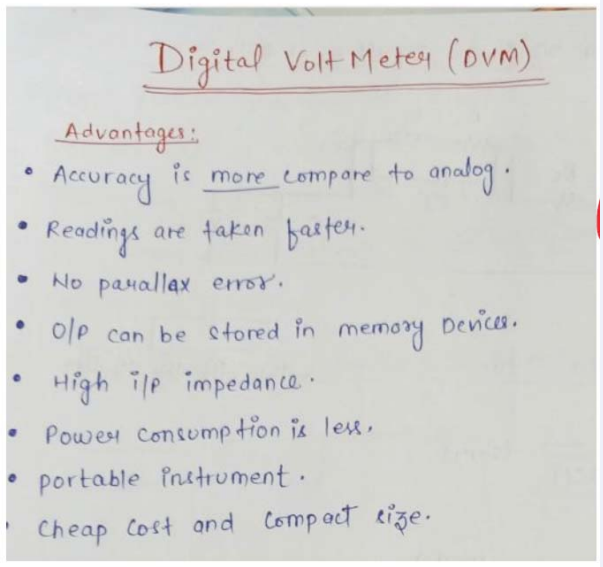
$$A = \frac{Z_{11}}{Z_{21}} = \frac{42}{25} = 1.68$$

$$B = \frac{Z_{11}Z_{22}}{Z_{21}} - Z_{12} = 33.8\ \Omega$$

End of Solution

147. Which one of the following features is **not** correct for Electronic Voltmeter (EVM)?
(a) Sensitivity is of the order of 10 μV (full-scale)
(b) In EVM, we also put some impedance matching stages
(c) Has very small frequency operating range
(d) Has internal protection against overloading

Ans. (c)



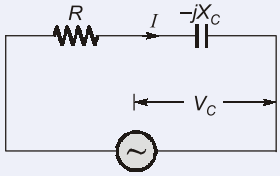
MADE EASY Class Notes

End of Solution

148. In a series R-C circuit, the value of R is 10 Ω and C = 25 nF. A sinusoidal voltage of 50 MHz is applied and the maximum voltage across the capacitance is 2.5 V. The maximum voltage across the series combination will be nearly
(a) 233 V (b) 196 V
(c) 163 V (d) 136 V

Ans. (b)

$$X_C = \frac{1}{2\pi f_c} = \frac{1}{2\pi \times 50 \times 10^6 \times 25 \times 10^{-9}} = 0.1273\ \Omega$$



$$Z = \sqrt{R^2 + X_C^2}$$

$$Z = \sqrt{10^2 + (0.1273)^2} = 10.0008$$

$$|I| = \frac{V_C}{X_C} = \frac{2.5}{0.1273} = 19.64\ \text{A}$$

$$V = I \cdot Z$$

$$V = 196.4$$

End of Solution

149. An impedance $Z_1 = (2 - j5)\ \Omega$ is connected in parallel with another impedance of $Z_2 = (1 + j1)\ \Omega$. If the applied voltage is $17\angle 0°$ V, then the currents through Z_1 and Z_2 are respectively

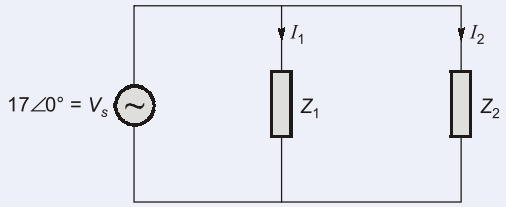
(a) $3.16\angle 68.2°$ A and $10.02\angle -35°$ A

(b) $2.16\angle 48.2°$ A and $10.02\angle -35°$ A

(c) $3.16\angle 48.2°$ A and $12.02\angle -45°$ A

(d) $2.16\angle 48.2°$ A and $12.02\angle -45°$ A

Ans. (c)



$$I_1 = \frac{V_s}{Z_1} = \frac{17\angle 0°}{2 - j5} = 3.16\angle 68.2°$$

$$I_2 = \frac{V_s}{Z_2} = \frac{17\angle 0°}{1 + j1} = 12.02\angle -45°$$

End of Solution

150. The P-N junction diodes and thermistors can be used to compensate for variations in current, thus stabilizing the operating point. Such methods are known as

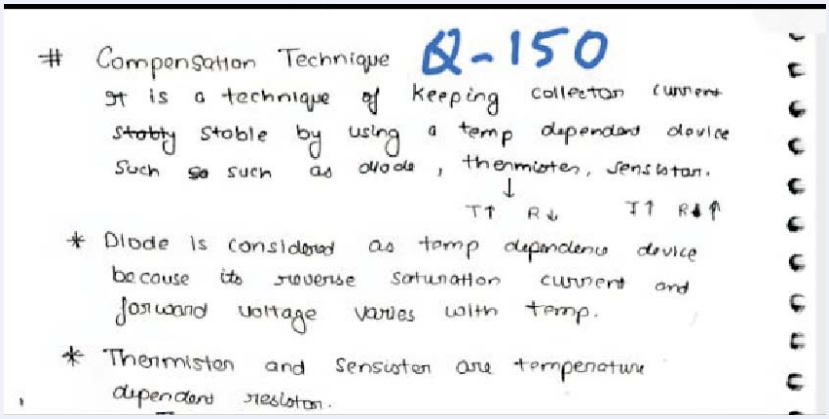
(a) thermal runaway

(b) thermal stabilization

(c) bias compensation

(d) fixed bias

Ans. (c)



MADE EASY Class Notes

End of Solution

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