A mind all logic is like a knife all blade. It makes the hand bleed that uses it -
Rabindranath tagore.

$$1dB3 = 20\log_{10}(10000) + 20\log_{10}(900\times10^6) - 147.35$$
$$= 80 + 179.0849 - 147.35$$
$$= 111.7349$$

$$\text{In } dBm = 47 - 111.7349 = -64.7349$$

$$\lambda = \frac{c}{f} = \frac{3\times10^8}{900\times10^6}$$

* Increasing the capacity of cells -
adding new channels
frequency borrowing
split the channels cells.

* Two types of channels -

- Control channels - setting up & maintaining calls
- Traffic channels.
- setting up a call b/w two stns -
- Mobile unit initialization - SX
- Mobile originated call.
- paging
- Call accepted -
- [illegible] call

WMT

1) 50 W power
dBm = 10 log (Power mw) = 10 log (50,000) = 47 dBm
-1w = 1000 50w x 1000 = 50000 mw
dBW = 10 log (Power w) = 10 log (50) = 17 dBW
→ Power mW = 1000 Power W
decibel milliwatts.

2) Frequency 900 MHz = 900 x 10^6
distance = 100m

$L_{dB} = 20 \log_{10}(d) + 20 \log_{10}(F) - 147.35$

$= 20 \log_{10}(100) + 20 \log_{10}(900 \times 10^6) - 147.35$
$= 40 + 179.0849 - 147.35$
$= 219.0849 - 147.35$
$= 71.7349$

As we need the recieved power in dBm
$= 47 - 71.52 = -24.52$ dBm

3) Freq = 900 x 10^6
dist = 10 x 1000 = 10000

16th aug - Submission

Assignment No

1) What is spread spectrum? Explain the benefits of a spread spectrum
2) Explain FHSS & DSSS?
3) Explain Multiplexing
4) Differentiate btw FDM & TDM.
5) What are main problems of signal propagation. Why do radio waves not always follow a straight line? Why is reflection both useful & harmful
6) What are convolution ports. Write the sequence diag & encoder for n = 2, smallcase. capital case = 3 K = 3. Encode the bit seq 10110 for (2, 1, 3)

* Antenna gain is a measure of the directionality of an antenna.
  It is defined as the power op in particular direction.
* Effective area it is related to the physical size of the antenna & its shape.

Types of antenna	Effective area (m^2)	power gain
1) Isotropic antenna	$\lambda^2/4\pi$	1
2) Dipole	$1.5\lambda^2/4\pi$	1.5
3) Half wave dipole	$1.64\lambda^2/4\pi$	1.64
4) Parabolic	$0.56A$	$7.8/\lambda^2$

1/8/18

WMT

- Free space path loss (FSPL)

$P_r = \frac{1}{d^2}$ P_r = recieved Power

$S = 4\pi d^2$

d - distance b/w sender & Reciever

- For ideal isotropic antenna the free space path is

$\frac{P_t}{P_r} = \frac{(4\pi d)^2}{\lambda^2} = \frac{(4\pi fd)^2}{c^2}$

λ - wavelength, f - freq. $c = 3 \times 10^8$

- For other antenna's the gain of the antenna which yeard's the foll free space loss eqn

$$\frac{P_t}{P_r} = \frac{(4\pi)^2 d^2}{G_r G_t \lambda^2} = \frac{(\lambda d)^2}{\lambda_r \lambda_t} = \frac{(cd)^2}{f^2 A_r A_t}$$

A_r - Effective area of recieving antenna

A_t — " — transmitting antenna

- FSPL on decibels (dB)

$$\begin{aligned} dB &= 10 \log P_t/P_r \\ &= 10 \log_{10}\left(\left(\frac{4\pi}{c} d_f\right)^2\right) \\ &= 20 \log_{10}\left(\frac{4\pi}{c} d_f\right) \\ &= 20 \log_{10}(d) + 20 \log_{10}(f) + 20 \log_{10}(4\pi/c) \\ &= 20 \log_{10}(d) + 20 \log_{10}(f) - 147.35 \\ &= -20 \log_{10}(\lambda) + 20 \log_{10}(d) + 21.98 \text{ dB} \end{aligned}$$

For a parabolic reflective antenna with a distance of 2 meters, operating at 16 GHz. What is the effective area & the antenna gain?

→ parabolic A = area of area = πr^2

Eff power gain = $7A/\lambda^2$

$\lambda = c/f = \frac{3\times10^8}{16\times10^3}$ = 300,000,000 0.187

$= \frac{7A(c)^2}{(f)^2}$ $= \frac{7A}{\lambda^2}$

$= \frac{7A(3\times10^8)^2}{}$ $= \frac{7A}{(0.187)^2}$ $= \frac{7\pi r^2}{(0.187)^2}$

$= \frac{7\times3.14\times41}{(0.187)^2}$

$= \frac{21.98}{0.035}$ 628 dB

Effective area = 0.56 A

= 0.56 × 3.14 = 1.7584 m^2

2) Suppose a transmitter produced 15 watts of power
i) Express the transmit power in units of dBM & dBW
ii) If the transmitter power is applied to a unity gain antenna with a 900 MHz carrier freq, what is the received power in dBM at a free space dist of 100 m
iii) Repeat b for a dist of 10 Km.

$10 \log \frac{P_t}{P_r}$ dBM

$E = P_4\ P_2\ P_1$
$1\ 0\ 1 = 5$

5^{th} bit there is an error while transmitting an code

invert the 5^{th} bit

current bit - 1 0 0 1 0 1 1

2) recieved bits are 0 1 0 0 0 1 1 Assume odd parity.

D_7	D_6	D_5	P_4	D_3	P_2	P_1
0	1	0	0	0	1	1

detect the error (if any)

analyzing $P_1 \Rightarrow 1, 3, 5, 7$

$= 1\ 0\ 0\ 0 = 1$

No error

$P_2 \Rightarrow 2, 3, 6, 7$

$= 1\ 0\ 1\ 0 = 0$

error

$P_4 \Rightarrow 4, 5, 6, 7$

$= 0\ 0\ 1\ 0 = 1$

No error

$E = P_4\ P_2\ P_1$

$= 1\ 0\ 1$

$= 5$

Invert 5^{th} bit

current bit - 0 1 1 0 0 1 1

correct code.

Q.2

$D_7\ D_6\ D_5\ P_4\ D_3\ P_2\ P_1$

$P_1 \Rightarrow (1, 3, 5, 7)$

$P_2 \Rightarrow$ check 2, skip 2, check 2, skip 2,
$\Rightarrow (2, 3, 6, 7, 10, 11, \ldots)$

$P_4 \Rightarrow$ check 4, skip 4, ...
$\Rightarrow (4, 5, 6, 7, 12, 13, 14, 15, \ldots)$

Eg:- $D_7\ D_6\ D_5\ P_4\ D_3\ P_2\ P_1 \Rightarrow$ | 1 | 1 | 0 | 1 | | |

$P_1 \Rightarrow (P_1, D_3, D_5, D_7, \ldots) \Rightarrow 101 = 0$ even = 0
$P_2 \Rightarrow (P_2, D_3, D_6, D_7) \Rightarrow 111 = 1$ odd = 1
$P_4 \Rightarrow (P_4, D_5, D_6, D_7) \Rightarrow 011 = 0$
new data $\Rightarrow$ | 1 | 1 | 0 | 0 | 1 | 0 | 0 |

i) A 7 bit Hamming code is recieved as 1011011. Assume even parity and state whether the recieved code is correct or wrong. If wrong, locate the bit in error.

D_7	D_6	D_5	P_4	D_3	P_2	P_1
1	0	1	1	0	1	1

- Detect the error (if any)
- analysing $P_1 \Rightarrow (1, 3, 5, 7) \Rightarrow \{1, 0, 1, 1 = 1$

Error in Parity P_1

$P_2 \Rightarrow (2, 3, 6, 7) = 1001 = 0$

No error.

$P_4 \Rightarrow (4, 5, 6, 7) = 1101 = 1$

Error in P_4

Kim & moon (1998) describe emotions

attractiveness
symmetry
sophistication
trustworthiness
awkwardness
elegance
simplicity.

WMT

Hamming Code—

Error correction & detection.
Only for single bit error.
structure — (7, 4)
↑
original data

power of 2 bit position are marked as parity bits (1, 2, 4, 8, ..).
Other bits are for data.

$D_7\ D_6\ D_5\ P_4\ D_3\ P_2\ P_1$

Rule to determine parity bits
The value of parity bit is determined by the seq of bit that is alternatively checks & skips.

$2^P \geq P+m+1$.

$P_1 \Rightarrow$ check 1, skip 1, check 1, skip 1.