

DISCRETE

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Question : Consider a carrier signal which is amplitude modulated by a single-tone sinusoidal message signal with a modulation index of 50%. If the carrier and one of the sidebands are suppressed in the modulated signal, the percentage of power saved (rounded off to one decimal place) is

(GATE EC 2021)

Solution: The percentage modulation,

Parameters	Values	Description
m	50%	Percentage modulation
P_t		Total power of the modulated AP
P_c		Power of the carrier signal
P_s		Saved power

TABLE 0
PARAMETERS

$$m = 50\% \quad (1)$$

$$= 0.5 \quad (2)$$

The total power is due to the carrier and the two sidebands,

$$P_t = P_c \left[1 + \frac{m^2}{2} \right] \quad (3)$$

Now as the carrier signal and one of the sidebands are suppressed then total saved power,

$$P_s = P_c \left[1 + \frac{m^2}{4} \right] \quad (4)$$

So percentage power saved,

$$= \frac{P_s}{P_t} \times 100\% \quad (5)$$

$$= \frac{P_c \left[1 + \frac{m^2}{4} \right]}{P_c \left[1 + \frac{m^2}{2} \right]} \times 100\% \quad (6)$$

$$= \frac{1 + \frac{1}{16}}{1 + \frac{1}{8}} \times 100\% \quad (7)$$

$$= 94.44\% \quad (8)$$

Hence, the percentage power saved is 94.4%.