Sri

SAI RAM ENGINEERING COLLEGE

INSTITUTE OF TECHNOLOGY

West Tambaram, Chennai - 44

YEAR	SEM
II	III

EC8394

ANALOG AND DIGITAL COMMUNICATION

UNIT No. 3- DIGITAL COMMUNICATION

3.4 BANDWIDTH EFFICIENCY

BANDWIDTH EFFICIENCY - INFORMATION DENSITY OR SPECTRAL EFFICIENCY

- Bandwidth efficiency is the ratio of transmission bit rate to minimum required bandwidth.
- Used to compare the performance of digital modulation techniques.
- When bandwidth efficiency is normalized to 1-Hz bandwidth, it gives number of bits that can be propagated per hertz of bandwidth

$$B\eta = \frac{transmission\ \text{bit rate (bps)}}{\text{min}\,imum\ \text{bandwidth (Hz)}} = bits/cycle$$

Where $B\eta$ = bandwidth efficiency

ASK, FSK, PSK & QAM Summary

Modulation	Encoding Scheme	Outputs Possible	Minimum Bandwidth	Baud	$B\eta$
ASK	Single bit	2	f_b	f_b	1
FSK	Single bit	2	f_b	f_b	1
BPSK	Single bit	2	f_b	f_b	1
QPSK	Dibits	4	$f_b/2$	$f_b/2$	2
8-PSK	Tribits	8	$f_b/3$	$f_b/3$	3
8-QAM	Tribits	8	$f_b/3$	$f_b/3$	3
16-QAM	Quadbits	16	$f_b/4$	$f_b/4$	4
16-PSK	Quadbits	16	$f_b/4$	$f_b/4$	4
32-PSK	Five bits	32	$f_b/5$	$f_b/5$	5
64-QAM	Six bits	64	$f_b/6$	$f_b/6$	6

Bandwidth efficiency

Spectral efficiency, spectrum efficiency or bandwidth efficiency refers to the information rate that can be transmitted over a given bandwidth in a specific communication system.

Bandwidth efficiency describes the ability of a modulation scheme to accommodate data within a limited **bandwidth**. Power **efficiency** describes the ability of the system to reliably send information at the lowest practical power level. In most systems, there is a high priority on **bandwidth efficiency**.

What are the bandwidth requirements for digital modulation?

It is a measure of the frequency range that is occupied by a modulated signal (carrier wave + information). The bandwidth of a channel is the frequency range over which it can transmit a signal with reasonable fidelity. Though there is an infinite spectrum of frequencies available, it is not possible to use every frequency for communication purposes, except only those under a few hundred GHz