

13. In a PCM systems, the signal $(t)=\{\sin(100 \pi t+\cos(100 \pi t))\}$ is sampled at the Nyquist rate. The samples are processed by a uniform quantizer with step size 0.75V. The minimum data rate of the PCM system in bits per second is [GATE-2014] []
- A) 200bps B)300bps C)400bps D)500bps
14. Quantizing noise can be reduced by increasing the number of samples per second. It is true
A) Yes, it is B) no, it is not C) not necessarily D) none
15. In PCM a system, the quantization noise depends upon []
A) The number of quantization levels only B) the sampling rate only C) both D) none
16. The signal to quantization the noise ratio in PCM system depends upon []
A) Sampling rate B) number of quantization levels C) message signal band width D) none
17. Indicate which of the following systems is digital? []
A) pulse- position modulation B) pulse- code modulation
C) pulse- width modulation D) pulse- frequency modulation
18. Quantizing noise occurs in []
A) time- division multiplex B) frequency- division multiplex
C) pulse- code modulation D) pulse- width modulation
19. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency which is not valid is [GATE-2013] []
A) 5 kHz B)12 kHz C) 15 kHz D)20 kHz
20. The biggest disadvantages of PCM []
A) Its inability to handle analog signals B) Its incompatibility with TDM
C)The high error rate which is quantizing noise reduces D) The large bandwidth that is required for it
21. Pre emphasis is used to amplify []
A) Low frequencies B) High frequencies C) Both low and high D) none
22. The quantization noise is produced in []
A) All pulse modulation system B) PCM C) all modulation system D) none
23. One of the following systems is analog []
A) PCM B) delta C) differential PCM D) PAM
24. For an efficient communication in PCM system number of samples per second must at least Be equal to -----the highest modulating frequency. []
A) Twice B) Thrice C)a&b D) none
25. In PCM system output S/N increases _____ with band width []
A) Linearly B) exponentially C) inversely D) none
26. A signal having uniformly distributed amplitude in the interval (-V to +V), is to be encoded using PCM with uniform quantization. The SNR is determined by the [GATE-1988] []
A)dynamic B)sampling C)number of quantizing levels D)power spectrum of signal
27. In a DM system, the granular noise occurs when the modulating signal []
A) increase rapidly B) remains constant C) decrease rapidly D) none
28. Quantization noise is produced in []
A) All pulse modulation system B) PCM C) all modulation system D) none
29. The main advantage of PCM signal is []
A) Lower bandwidth B) higher band width C) lower noise D) none

30. For transmission of normal speech signal the PCM channel needs a band width of []
A) 64 kHz B) 8 kHz C) 4 kHz D) none
31. The minimum step-size required for a Delta-Modulation operating at 32K samples/sec to track the signal (here $u(t)$ is the unit-step function) $x(t)=125t\{u(t)-u(t-1)\}+(250-125t)\{u(t-1)-u(t-2)\}$ so that slope-overload is avoided would be [GATE-2006] []
A)2-10 B)2-8 C)2-6 D)2-4
32. The input to a linear DM having a step-size $\Delta=0.628$ is a sine wave with frequency f_m and peak amplitude E_m . If the sampling frequency $f_s = 40$ KHz, the combination of the sine-wave frequency and the peak amplitude, where slope overload will take place is $E_m f_m$ [GATE-2003] []
A) 0.3 V 8 KHz B) 1.5 V 4 KHz C)1.5 V 3 KHz D)3.0 V 1 KHz
33. PCM system use non uniform quantization in order to []
A) Raise SNR for low level signals B) increase the maximum SNR
C) Cut down the required band width of transmission D)None
34. Granular noise is associated with []
A) PCM B) DPCM C) DM D) QAM
35. Signal to quantization noise ratio of a PCM system using 8-bit words for the analog signal that does not exceed its quantization boundary is []
A) 48 dB B) 54 dB C) 52.7dB D) 64 dB
36. In PCM if the transmission path is very long []
A) Repeater stations are used B) pulse width may be increased
C) Pulse amplitude is increased D) pulse spacing is reduced
37. In PCM the biggest disadvantage compared to analog modulation is []
A) Large bandwidth B) large noise C) inability to handle analog signals D) none
38. In an ADM system the output signal amplitudes for 1's and 0's are []
A) Fixed and repetition rate is also fixed B) fixed but the repetition rate is variable
C) Variable and the repetition rates is also variable
D) Variable but the repetition rate is fixed
39. In delta modulation, the slope overload distortion can be reduced by [GATE-2007] []
A) Decreasing the step size B) decreasing the granular noise
C) decreasing the sampling noise D) Increasing the step size
40. For uniform quantization with 32 levels, the quantized output can be represented by n binary digits where n is []
A) 5 B) 8 C) 6 D) 4

Prepared by: U. Srinivasulu, M.Prasanth.



SIDDHARTH GROUP OF INSTITUTIONS: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (OBJECTIVE)

Subject with Code: DC (16EC421)

Course & Branch: B. Tech - ECE

Year & Sem: III-B. Tech & II-Sem

Regulation: R16

UNIT – II
BASEBAND PULSE TRANSMISSION

1. In a baseband communication link, frequencies up to 3500 Hz are used for, signaling. Using a raised cosine pulse with 75% excess bandwidth and for no inter-symbol interference, the maximum possible signaling rate in symbols per second is [GATE-2012] []
 A)1750 B)2625 C)4000 D) 5250
2. The power spectral density of white Gaussian noise is []
 A) $N_0/2$ B) N_0 C) $2/N_0$ D) 2
3. The shape of the impulse of a matched filter is similar to []
 A) Input signal B) shape of output C) shape of square D) none
4. In matched filter erfc is a monotonically.....function []
 A) Decreasing B) increasing C) equal D) none
5. The probability error of matched filter is does not depend upon []
 A) Input signal B) shape of output C) shape of square D) shape of signal
6. Correlator is known as []
 A) Correlates the received signal B) correlates the input signal
 C) A&B D) none
7. ISI means []
 A) Inter symbol interference B) inter system interference
 C) Inter symbol inferior D) All the above
8. The function which produces a zero ISI is called as....function []
 A) Cosine B)sinc C) tan D) none
9. The process of sampling is called as []
 A) Extraction B) interaction C) decoding D) encoding
10. The shape of thePattern is shape of human eye []
 A) Eye pattern B) eye symbol C) eye D) none
11. A Matched filter []
 A) Minimizes the output S/N B) reduces the transmission energy requirement
 C) Minimizes the probability of error D) is unique for all signaling representations
12. For the digital data 1,0 represented as +V volts and - V volts respectively, which of the following can act as a Matched filter? []
 A) Differentiator B) Integrator C) Sampling Circuit D) Bit synchronizer

13. An analog signal is band-limited to 4 KHz, sampled at the Nyquist rate and the samples levels are assumed to be independent and equally probable. If we transmit two quantized samples per second, the information rate [GATE-2011] []
 A) 1 bit/sec B) 2 bit/sec. C) 3 bit/sec D) 4 bit/sec
14. Which of the following is a Causal system? []
 A) Ideal LPF B) Matched filter C) Ideal BPF D) $\theta=0$ System with transfer function $H(f) = 0$ for $20\text{KHz} < f < 40\text{KHz}$
15. A band limited signal is sampled at the Nyquist rate. The signal can be recovered by passing the samples through []
 A) AN RC filter B) An envelope detector
 C) A PLL D) An ideal low-pass filter with the appropriate bandwidth
16. Nyquist's interval indicates []
 A) The separation between the adjacent samples of the sampled signal
 B) Period of the sampling signal C) period of the base band signal
 D) Maximum separation between the adjacent samples of the sampled signal
17. Matched filter gives an impulse response which is []
 A) zero for $t > 0$ B) zero for $t = 0$ C) zero for $t < 0$ D) None
18. A signal has frequency components from 300 Hz to 1.8 KHz. The minimum possible rate at which the signal has to be sampled is --- [GATE-1991] []
 A) 360 samples/sec B) 3600 samples/sec C) 36000 samples/sec D) 36 samples/sec
19. If the Nyquist's rate of a signal $x(t)$ is f_0 , the Nyquist's rate of its integral is []
 A) f_0 B) $f_0/2$ C) $2f_0$ D) $f_0/4$
20. The Nyquist interval for the signal $x(t) = [(\text{Sin}504t)/(4t)] + [(\text{Sin}1004t)/(4t)]^2$ is []
 A) $100/n$ sec B) $n/200$ sec C) $n/100$ sec D) $200/n$
21. An analog voltage in the range 0 to 8 V is divided in 16 equal intervals for conversion to 4-bit digital output. The maximum quantization error (in V) is _____ [GATE-2014] []
 A) 0.25V B) 0.025V C) 0.2V D) 0.5V
22. If $X(t)$ is a band limited signal with Nyquist's rate of F_0 , then $X(t) \cdot \cos W_0 t$ is []
 A) Band pass signal B) Band limited signal
 C) of Nyquist's rate $2F_0$ D) of band width $F_0/2$.
23. The impulse response of the filter matched to the input signal $x(t) = u(t) - u(t-T)$ is []
 A) $x(t)$ B) $x(-t)$ C) $x(2t)$ D) $2 \cdot x(t)$
24. When the noise is white Gaussian noise then optimum filter is called []
 A) Gaussian filter B) matched filter C) white filter D) none
25. The S/N ratio of matched filter depends on----- []
 A) $2E$ B) $2E/N_0$ C) N_0 D) E
26. The channel B.W is equal to the B.W of message signal is called as []
 A) Channel B) base band channel C) baseband D) none
27. The data transmission system which uses the base band channel is called as []
 A) Pass band B) base band C) band D) none
28. The matched filter for rectangular pulse may be implemented using a circuit is called----- circuit []
 A) Integrate B) Dump C) Integrate&Dump D) design
29. ISI will introduce errors in-----signal []

- A) Transmitting B) Received signal C) detected D) none
30. The special value of bit rate $R_b=2B_0$ is called----- []
 A) Nyquist rate B) Nyquist interval C) Nyquist B.W D) ideal Nyquist channel
31. The special value of bit rate $R_b=2B_0$, where B_0 is called----- []
 A) Nyquist rate B) Nyquist interval C) Nyquist B.W D) ideal Nyquist channel
32. The ideal base band transmission can be described by time or frequency domain is called []
 A) Nyquist rate B) Nyquist interval C) Nyquist B.W D) ideal Nyquist channel
33. In ideal channel the B_0 is -----to bit rate []
 A) Equal B) Half C) twice D) thrice
34. Base band M-ary PAM system requires-----bandwidth []
 A) More B) less C) equal D) none
35. Base band M-ary PAM system requires-----power for their P_e []
 A) More B) less C) equal D) none
36. Base band M-ary PAM system requires-----eye patterns []
 A) $(M+1)$ B) $(M-1)$ C) M D) none
37. 1.0 kHz signal is sampled at the rate of 1.8 kHz and the samples are applied to an ideal rectangular LPF with cut-off frequency of 1.1 kHz, then the output of the filter contains [GATE-2015] []
 A) T B) $T-1$ C) $T+1$ D) none
38. The height of eye opening defines----- []
 A) Margin over noise B) Margin noise C) Margin under noise D) none
39. When the effect of ISI is severe the eye is completely ----- []
 A) Closed B) opened C) stacked D) none
40. When the effect of ISI is less the eye is completely ----- []
 A) Closed B) opened C) stacked D) none

Prepared by: U. Srinivasulu, M. Prasanth



SIDDHARTH GROUP OF INSTITUTIONS: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (OBJECTIVE)

Subject with Code : DC (16EC0421)

Course & Branch: B.Tech - ECE

Year & Sem: III-B.Tech & II-Sem

Regulation: R16

UNIT – III

Signal Space Analysis

1. The Auto-correlation function of White Noise is []
 A) Impulse function B) Constant C) Sampling function D) Step function
2. A Binary communication system transmits equally likely 1's and 0's. A received '1' produces a voltage of 1V in the presence of Zero mean Gaussian noise with unity variance. A received '0' produces zero volts in the presence of same above noise. If the received signal is above the threshold, the decision is in favour of 1. The probability with which a transmitted 1 is received as 0 is []
 A) $Q(-0.5)$ B) $Q(1)$ C) $Q(-1)$ D) $Q(0.5)$
3. If E_b , the energy per bit of a Binary signal is 106 and the White noise PSD $\eta/2=105$, then, the maximum output S/N in dB is []
 A) 13 B) 1 C) 20 D) 10
4. Noise with uniform PSD of N w/Hz is passed through a filter with transfer function $H(\omega) = 2 \cdot \exp(-j\omega t D)$ followed by an ideal LPF with pass band over $(0, B)$. The output Noise power in watts is []
 A) $2NB$ B) $4NB$ C) $8NB$ D) $16NB$
5. The probability density function of uniform noise extending from -1.5 v to +1.5 v is []
 A) $1/3$ B) $1/6$ C) $2/3$ D) $3/2$
6. A modulation scheme with a densely packed constellation diagram is []
 A) More energy efficient B) with more probability of error
 C) More power efficient D) with less probability of error
7. The noise in a communication channel is considered to be Gaussian random variable with mean=1 and variance = 3. The area enclosed by its pdf curve over $(0, V)$ is []
 A) 1 B) 2 C) 3 D) None
8. Zero mean, white Gaussian noise is passed through an Ideal LPF with pass band extending from -5KHz to +5KHz. The output is zero at time $t =$ []
 A) 0.15sec B) 0.2sec C) 0.35 sec D) 0.55sec
9. The area enclosed by the density function of Gaussian Noise with mean=2 and variance of 5 is []
 A) 2.5 B) 1 C) 3 D) 2

10. AWGN means []
 A) Additive white Gaussian noise B) additive wheat Gaussian noise
 C) Additive white Gal noise D) none
11. Each multiplier is followed by a summer is called as []
 A) Analyzer B) synthesizer C) vector D) all the above
12. A group of integrators is called as []
 A) Analyzer B) synthesizer C) vector D) all the above
13. The vector s_i is also called as..... []
 A) System B) signal C) noise D) none
14. N-dimensional Euclidean space is called the..... []
 A) Signal vector B) system vector C) signal space D) none
15. The squared length of ant signal vector S_i is... []
 A) Dot product B) inner product C) above a&b D) none
16. The vectors s_i & s_k are.....to each other []
 A) Parallel B) perpendicular C) orthogonal D) none
17. In gram-Schmidt orthogonalization procedure if $N=M$ the signals are... []
 A) Linear B) nonlinear C) periodic D) non periodic
18. In gram-Schmidt orthogonalization procedure if $N<M$ the signals are... []
 A) Linear B) nonlinear C) periodic D) non periodic
19. δ_{ij} is..... []
 A) kronecker delta B) delta C) Necker D) none
20. For the designing of optimum receiver ____ representation is used []
 A) Geometric B) metric C) graphical D) none
21. In gram procedure modulated wave is divided into []
 A) Discrete time B) continuous time C) A&B D) none
22. In the representation of set of energy signals is _____ []
 A) M B) N C) S D) E
23. If $N=M$ the signals are []
 A) linear B) non linear C) a & b D) none
24. If $N<M$ the signals are []
 A) linear B) non linear C) a & b D) none
25. In correlates the vector X is called as _____ []
 A) observation vector B) observation element C) a & b D) none
26. In correlates the vector X_j is called as _____ []
 A) observation vector B) observation element C) a & b D) none
27. The set of message points corresponding to signals is called as ____ []
 A) signal B) signal constellation C) a & b D) none
28. The average probability error is give by []
 A) P_e B) P_a C) E_p D) none
29. A Matched filter []
 A) Minimizes the output S/N B) reduces the transmission energy requirement
 C) Minimizes the probability of error D) is unique for all signaling representations

30. In a particular digital communication system application, the receiver designed is an optimum coherent receiver, the channel noise is white and bits are transmitted using rectangular pulses then which of the following statements would be inconsistent []
 A) A correlator receiver B) a matched filter receiver C) dump receiver D) none
31. Matched filter gives an impulse response which is []
 A) zero for $t > 0$ B) zero for $t = 0$ C) zero for $t < 0$ D) None
32. A Matched filter []
 A) Maximizes output S/N ratio and increases the bit error probability
 B) Minimizes output S/N ratio and increases the bit error probability
 C) Minimizes output S/N ratio and decreases the bit error probability
 D) Maximizes output S/N ratio and decreases the bit error probability
33. Which of the following statements is correct? []
 A) Matched filter is a unique system that can be used for any signaling format.
 B) Impulse response of a Matched filter is zero for $t < 0$.
 C) The output S/N of a Matched filter is independent of i/p signal energy
 D) The impulse response of a matched filter is same as the input signal
34. For the digital data 1,0 represented as +V volts and - V volts respectively, which of the following can act as a Matched filter? []
 A) Differentiator B) Integrator C) Sampling Circuit D) Bit synchronizer
35. Which of the following is a Causal system? []
 A) Ideal LPF B) Matched filter C) Ideal BPF D) System with transfer function
36. The impulse response of the filter matched to the input signal $x(t) = u(t) - u(t-T)$ is []
 A) $x(t)$ B) $x(-t)$ C) $x(2t)$ D) $2.x(t)$
37. The combination of matched filter with envelope detector is called as []
 A) Non coherent matched filter B) coherent matched filter
 C) a & b D) none
38. The output of a matched filter is []
 A) sine B) cosine C) rectangular D) none
39. The matched filter output when []
 A) $\theta = 0$ B) $\theta = 180$ C) a & b D) none
40. If the channel is noiseless information conveyed is ___ and if it is useless channel information conveyed is ___ []
 A) 0,0 B) 1,1 C) 0,1 D) 1,0

Prepared by: **U.Srinivasulu, M.Prasanth**


SIDDHARTH GROUP OF INSTITUTIONS: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (OBJECTIVE)
Subject with Code: DC (16EC421)

Course & Branch: B. Tech - ECE

Year & Sem: III-B. Tech & II-Sem

Regulation: R16

UNIT – IV
Passband Data Transmission

1. In 8-PSK system, adjacent phasors differ by an angle given by(in degrees) []
 A) $n/4$ B) $n/8$ C) $n/2$ D) $n/6$
2. A BPSK system is transmitting data at a rate of 1Mbps.The minimum B.W and the Baud rate of the above system is []
 A) 1MHz, 1Mbps B) 0.5MHz, 1Mbps C) 0.5MHz,0.5Mbps D) 1MHz, 0.5Mbps
3. Adjacent phasors in M-ary PSK system differ in Phase by []
 A) n/M B) $2n/M$ C) M D) $2M$
4. Orthogonal PSK means []
 A) DPSK system B) Offset-QPSK C) Non-Offset D) 8-PSK system
5. The band width of BFSK is []
 A) $4F_b$ B) $2F_b$ C) F_b D)None
6. The band width of BPSK is []
 A) $4F_b$ B) $2F_b$ C) F_b D) None
7. The band width of DPSK is []
 A) $4F_b$ B) $2F_b$ C) F_b D) None
8. The noise immunity of BFSK is []
 A) High B) low C) higher than BPSK D) None
9. Quadrature multiplexing is []
 A) High B) low C) higher than BPSK D) None
10. The noise immunity of DPSK is []
 A) High B) low C) higher than BPSK D) None
11. Probability error of BFSK is []
 A) High B) low C) higher than BPSK D) None
12. Probability error of BPSK is []
 A) High B) low C) higher than BPSK D) None
13. Probability error of DPSK is []
 A) High B) low C) higher than BPSK D) None
14. The variable characteristic of BFSK is []
 A) Amplitude B) frequency C) phase D) None
15. The variable characteristic of BPSK is []

- A) Amplitude B) frequency C) phase D) None
16. The variable characteristic of BASK is []
- A) Amplitude B) frequency C) phase D) None
17. OOK means []
- A) On off keying B) on on keying C) off off keying D) None
18. BASK is also called as----- []
- A) On off keying B) on on keying C) off off keying D) None
19. Quadrature phase amplitude keying is also called as----- []
- A) QAM B) QPM C) QPSK D) Mary
20. The minimum band width required for a BPSK signal is equal to []
- A) Bit rate B) Baud rate C) signal bandwidth D) none
21. The following digital modulation techniques which have lowest bit error probability is []
- A) 8PSK B) BPSK C)DPSK D)QPSK
22. The Band width efficiency of 8-PSK system is []
- A) 2 B) 3 C) 4 D) 5
23. Error probability of FSK is []
- A) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{4N_0}}$ B) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{N_0}}$ C) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{2N_0}}$ D) None
24. Error probability of PSK is []
- A) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{4N_0}}$ B) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{N_0}}$ C) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{2N_0}}$ D) None
25. Error probability of QSK is []
- A) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{4N_0}}$ B) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{N_0}}$ C) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{2N_0}}$ D) None
26. Error probability of ASK is []
- A) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{4N_0}}$ B) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{N_0}}$ C) $P_e = \frac{1}{2} \operatorname{erfc} \sqrt{\frac{E}{2N_0}}$ D) None
27. The Band width efficiency of 16 QAM systems is []
- A) 4 B) 1 C) 2 D) 3
28. A digitally Modulated carrier in QPSK system is []
- A) Energy Signal B) Power signal C) both energy and power signal D) Neither energy nor power signal
29. The advantage of Offset QPSK is []
- A) Amplitude variations are less pronounced B) band width occupied is less
- C) Less transmitted power D) probability of error is less
30. The energy of the two possible signals in a BPSK system is []
- A) AB B) AB² C) A2Tb D)ATb
31. Non-coherent detection of FSK signal results in []
- A) More band width occupancy B) more probability of error
- C) Energy efficiency than BPSK D) less probability of error
32. Baud rate for a BFSK system is []
- A) Half of the bit rate B) twice the bit rate C) same as the bit rate D) one fourth the bit rate
33. The possible signal sets in which of the following systems are orthogonal []

- A) PSK over (0,TB) B) PSK over (0,TB) C) DPSK over (0,2TB) D) QPSK over (0,TB)
34. Mathematical representation of ASK for 0 is []
 A) $-A_c$ B) A_c C) $+A_c \cos 2\pi f_c t$ D) $-A_c \cos 2\pi f_c t$
35. is most effected by noise []
 A) ASK B) PSK C) FSK D) DPSK
36. Quadrature multiplexing is [GATE-98] []
 A) the same as FDM B) the same as TDM C) combination of FDM & TDM
37. For a given data rate , the bandwidth B_P of a BPSK signal and the bandwidth B_0 of the OOK signal are related as [GATE-98] []
 A) $B_P=B_0/4$ B) $B_P=B_0/2$ C) $B_P=B_0$ D) $B_P=2B_0$
38. The bit rate of a digital communication system is R kbits/s. The modulation used is 32-QAM. The minimum bandwidth required for ISI free transmission is [GATE-2013] []
 A) $R/10$ Hz B) $R/10$ kHz C) $R/5$ Hz D) $R/5$ kHz
39. For a bit of 8kbps, the possible values of the transmitted frequencies in a coherent binary FSK system are [GATE-2002] []
 A) 16-20 KHz B) 20-32 KHz C) 20-40 KHz D) 32-40 KHz
40. The message bit sequence input to DPSK modulator is 1,1,0,0,1,1. The carrier phase during the reception of the first two message bits is π, π .the carrier phase for the remaining four message bits is [GATE-88] []
 A) $\pi, \pi, 0, \pi$ B) $0, 0, \pi, \pi$ C) $\pi, \pi, 0, 0$ D) $0, \pi, \pi, \pi$

Prepared by: U. Srinivasulu, M.Prasanth

40. In ARQ system if no error is detected the decoder sends a []
A) NAK B) ACK C) request D) none

Prepared by: **U. Srinivasulu, M. Prasanth**