



ACE

Engineering Academy

Leading Institute for ESE/GATE/PSUs

Hyderabad | Delhi | Ahmedabad | Bhopal | Pune | Bhubaneswar | Bengaluru
Lucknow | Patna | Chennai | Vijayawada | Vizag | Tirupathi | Kukatpally | Kolkata

ESE – 2019

(MAINS)

Questions with Detailed Solutions

ELECTRONICS & TELECOMMUNICATION ENGINEERING

PAPER – II

ACE Engineering Academy has taken utmost care in preparing the **ESE-2019 MAINS** Examination solutions. Discrepancies, if any, may please be brought to our notice.

ACE Engineering Academy do not owe any responsibility for any damage or loss to any person on account of error or omission in these solutions. ACE Engineering Academy is always in the fore front of serving the students, irrespective of the examination type (GATE/ESE/PSUs/PSC/GENCO/TRANSCO etc.,).

All Queries related to **ESE - 2019 MAINS** Solutions are to be sent to the following email address
hyderabad@aceenggacademy.com | Contact Us : 040-23234418,19,20

ELECTRONICS & TELECOMMUNICATION ENGINEERING
ESE _MAINS_2019_PAPER – II

SUBJECT WISE REVIEW

SUBJECT(S)	LEVEL	Marks
Control Systems	Moderate	70
Signals & Systems	Easy	30
Analog and Digital Communication Systems	Moderate	90
Advanced Communication topics	Hard	70
Advanced Electronics Topics	Moderate	50
Computer Organization and Architecture	Moderate	90
Electro Magnetics	Moderate	80

Subject Experts,
ACE Engineering Academy

SECTION-A

01. (a) In a narrow band digital communication system the symbol error probability for the in-phase channel is P_{ei} and for quadrature phase channel is P_{eQ} . Prove that the probability of symbol error for the overall system is given by (P_e):

$$P_e = P_{ei} + P_{eQ} - P_{ei} P_{eQ} \quad (10 M)$$

Sol: The overall probability of correct reception is

$$P_C = (1 - P_{ei})(1 - P_{eQ}) = 1 - P_{ei} - P_{eQ} + P_{ei}P_{eQ}$$

The overall probability of error is

$$P_e = 1 - P_C = 1 - [1 - P_{ei} - P_{eQ} + P_{ei}P_{eQ}] = P_{ei} + P_{eQ} - P_{ei}P_{eQ}$$

01. (b) Consider a discrete time system with impulse response $h[n] = \left(\frac{1}{5}\right)^{2n} U[n]$. Find the value of constant A such that $h[n] - Ah[n-1] = \delta[n]$ and $\delta[n]$ is a unit impulse signal. (10 M)

Sol: $h(n) - Ah(n-1) = \delta(n)$

$$\left(\frac{1}{25}\right)^n - A\left(\frac{1}{25}\right)^{n-1} u(n-1) = \delta(n)$$

If $A = \frac{1}{25}$, then only LHS = RHS.

(or)

$$h(n) - Ah(n-1) = \delta(n)$$

Apply z-Transforms

$$H(z) - Az^{-1}H(z) = 1$$

$$H(z) = \frac{1}{1 - Az^{-1}} \quad (1)$$

$$\text{But } h(n) = \left(\frac{1}{5}\right)^{2n} u(n) = \left(\frac{1}{25}\right)^n u(n)$$

$$\text{Then } H(z) = \frac{1}{1 - \frac{1}{25}z^{-1}} \quad (2)$$

Compare (1) & (2)

$$\text{Then } A = \frac{1}{25}$$

ESE / GATE / PSUs 2020 - 2021

ADMISSIONS OPEN

GATE + PSUs - 2020

Regular Batches @ Dilsukhnagar	08 th & 22 nd July, 05 th & 20 th August 2019
Regular Batch @ Kukatpally	01 st July 2019
Regular Batches @ Pune	01 st & 15 th July 2019
Weekend & Regular Batches @ Chennai	06 th July 2019
Regular Batch @ Bengaluru	08 th July 2019

ESE + GATE + PSUs - 2020

Regular Batch @ Dilsukhnagar	08 th July 2019
Regular Batch @ Pune	01 st July 2019

GATE + PSUs - 2021

Morning Batches @ Abids	12 th July & 10 th August 2019
Morning & Evening Batches @ Dilsukhnagar	12 th July & 10 th August 2019
Morning & Evening Batches @ Kukatpally	12 th July & 10 th August 2019
Weekend Batches @ Pune	6 th July & 17 th August 2019
Weekend Batch @ Chennai	6 th July 2019
Weekend Batch @ Bengaluru	3 rd August 2019
Weekend Batch @ Vijayawada	7 th July 2019
Weekend Batch @ Tirupati	13 th July 2019
Weekend Batch @ Vizag	20 th July 2019

ESE + GATE + PSUs - 2021

Morning Batches @ Abids	12 th July & 10 th August 2019
Weekend Batches @ Pune	6 th July & 17 th August 2019

IES GENERAL STUDIES BATCH

Regular Batch @ Abids	12 th July 2019
Weekend Batch @ Pune	13 th July 2019

GENCO / TRANSO / DISCOMS BATCH

Regular Batch @ Abids	14 th July 2019
------------------------------	----------------------------

for more batch details please visit: www.aceenggacademy.com

01. (c) A digital computer has a memory unit with 32 bits per word. The instruction set consists of 240 different operations. All instructions have an operation code part (opcode) and an address part (allowed for only one address). Each instruction is stored in one word of memory.

(i) How many bits are needed for the opcode?

(ii) How many bits are left for the address part of the instruction?

(iii) What is the maximum allowable size of the memory?

(10 M)

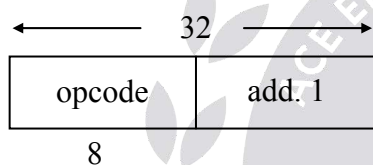
Sol: Word size = 32-bits

Number of instructions (operations) supported = 240.

Hence, number of bits in opcode = $\lceil \log_2 240 \rceil = 8$ -bits

Instruction size = 1 word = 32-bits

one-address instruction



Address size = $32 - 8 = 24$ -bits

(i) opcode bits = 8-bits

(ii) Address size = 24-bits

(iii) Size of memory = $2^{24} \times 32$ -bits = $2^{24} \times 4$ Bytes
 = 64 Mbytes

01. (d) The Radiation intensity of an antenna is

$$U(\theta, \phi) = \begin{cases} 2 \sin \theta \sin^3 \phi & 0 \leq \theta \leq \pi, 0 \leq \phi \leq \pi \\ 0 & \text{elsewhere} \end{cases}$$

Determine the directivity of the antenna.

(10 M)

Sol: $U(\theta, \phi) = 2 \sin \theta \sin^3 \phi$

$$0 \leq \theta \leq \pi \quad 0 \leq \phi \leq \pi$$

$$D = 4\pi \frac{U_{\max}}{P_{\text{rad}}}$$

$$P_{\text{rad}} = \int_S U(\theta, \phi) \sin \theta \, d\theta \, d\phi$$

$$P_{\text{rad}} = \int_S 2 \sin \theta \sin^3 \phi \sin \theta \, d\theta \, d\phi$$

$$P_{\text{rad}} = 2 \int_{\theta=0}^{\pi} \sin^2 \theta \, d\theta \int_{\phi=0}^{\pi} \sin^3 \phi \, d\phi = 2(2) \frac{1}{2} \frac{\pi}{2} (2) \frac{2}{3}$$

$$P_{\text{rad}} = \frac{4\pi}{3}$$

$$D = 4\pi \frac{2}{\left(\frac{4\pi}{3}\right)} = 6$$

$$D = 10 \log(6) = 7.78 \text{ dB}$$

01. (e) A graded index fiber has a characteristics refractive index profile of 1.85 and a core diameter of 60 μm . Compute the insertion loss due to a 5 μm lateral offset at an index matched fiber joint assuming the uniform illumination of all guided modes. (10 M)

Sol: $n_1 = 1.85$, radius $a = 30\mu\text{m}$, $y = 5\mu\text{m}$

Lateral coupling efficiency

$$\eta = \frac{16n_1^2}{(1+n_1)^4} \times \frac{1}{\pi} \left\{ 2 \cos^{-1} \left(\frac{y}{2a} \right) - \left(\frac{y}{a} \right) \left[1 - \left(\frac{y}{2a} \right)^2 \right]^{\frac{1}{2}} \right\}$$

Insertion loss due to lateral misalignment is
 $-10 \log \eta = 0.67 \text{ dB}$

01. (f) A mobile network transmits data having bandwidth of 200 Hz using a carrier frequency of 800 MHz. If the maximum speed of a vehicle is 120 km/hr, calculate the bandwidth and the cut-off frequencies of the filter at the receiver input. (10 M)

Sol: Speed of the vehicle $120 \text{ km/hr} = \frac{100}{3} \text{ m/sec}$, $f_c = 800 \text{ MHz}$, $\text{BW} = 200 \text{ Hz}$.

$$\text{Doppler shift } f_d = \frac{V_r f_o}{C} = \frac{100 \times 800 \times 10^6}{3 \times 3 \times 10^8} = 88.88 \text{ Hz.}$$

$$\begin{aligned} \text{Lower Cut-off frequency} &= f_c - f_d - 100 \text{ Hz} = 800 \text{ MHz} - 88.88 \text{ Hz} - 100 \text{ Hz} \\ &= 800 \text{ MHz} - 188.88 \text{ Hz} \end{aligned}$$

$$\begin{aligned} \text{Upper Cut-off frequency} &= f_c + f_d + 100 \text{ Hz} = 800 \text{ MHz} + 88.88 \text{ Hz} + 100 \text{ Hz} \\ &= 800 \text{ MHz} + 188.88 \text{ Hz} \end{aligned}$$

$$\text{BW} = 2f_d + 200 \text{ Hz} = 177.77 \text{ Hz} + 200 \text{ Hz} = 377.77 \text{ Hz}$$



ACE[®]
Engineering Academy
Leading Institute for ESE/GATE/PSUs



Scan QR Code
for Website

LONG TERM PROGRAM

ESE+GATE+PSUs-2021

Morning Batch

12th July 2019 @ Abids (EC/EE/ME/CE)

GATE+PSUs-2021

Morning Batches

12th July 2019

@ Abids (EC/EE/ME/CE/CSIT/IN)
@ Kukatpally (EC/EE/ME/CE/CSIT/IN),
@ Dilsukhnagar (EC/EE/ME),
@ Kothapet (CE)

Evening Batches

12th July 2019

@ Kukatpally (EC/EE/ME/CE/CSIT/IN)
@ Dilsukhnagar (EC/EE/ME)
@ Kothapet (CE)

Head Office Address: # 4-1-1236/1/A, Sindhu Sadan,
King Koti, Abids, Hyderabad – 500001, Telangana, India

website: www.aceenggacademy.com

ABIDS

040-23234418 / 19 / 20

KUKATPALLY

040-40199966, 93476 99966

DILSUKHNAGAR

040-40209345, 40044451

KOTHAPET

040-24034418 / 19



02. (a) Two speech signals $m_1(t)$ and $m_2(t)$ are used to generate a composite signal as:

$$s(t) = m_1(t) \cos\omega_c t + m_2(t) \sin\omega_c t$$

Assume both the messages are low pass in nature and have W Hz bandwidth.

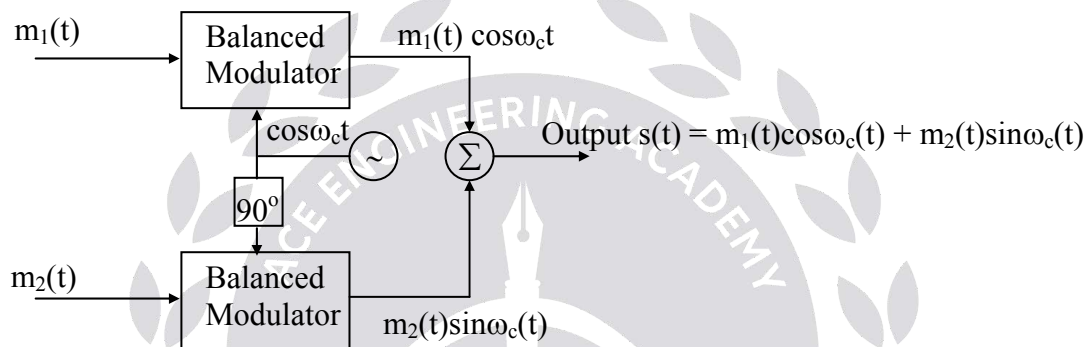
(i) Draw the block diagram and show the generation scheme of $s(t)$. (8 M)

(ii) Propose a demodulation scheme in the form of block diagram and show the recovery of the two signals $m_1(t)$ and $m_2(t)$. Assume $\omega_c \gg 2\pi W$. (12 M)

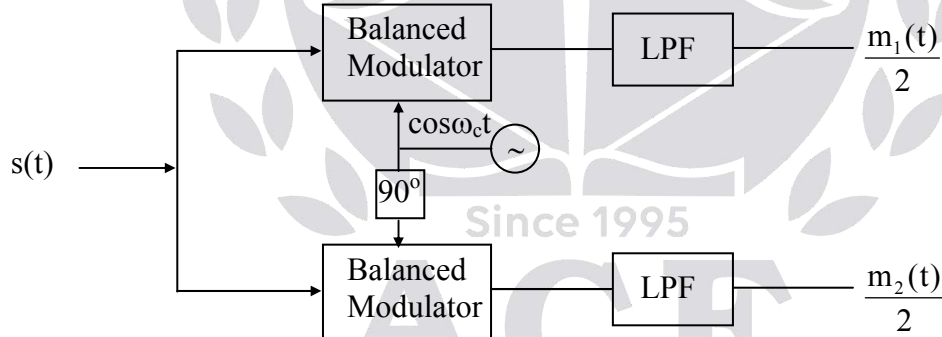
Sol:

(i) $s(t) = m_1(t) \cos\omega_c(t) + m_2(t) \sin\omega_c(t)$

Generation:



(ii) Demodulation:



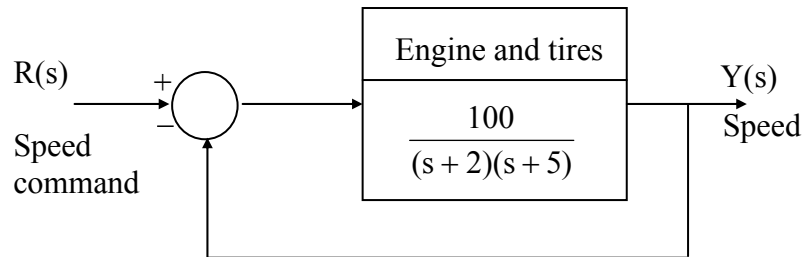
Output of 1 multiplier is

$$\begin{aligned} &= s(t) \cos\omega_c t \\ &= [m_1(t) \cos\omega_c(t) + m_2(t) \sin\omega_c(t)] \cos\omega_c t \\ &= m_1(t) \cos^2 \omega_c t + \frac{m_2(t)}{2} \sin 2\omega_c t \end{aligned}$$

Output LPF is $\frac{m_1(t)}{2}$

Similarly, output of 2nd LPF is $\frac{m_2(t)}{2}$

02. (b) The engine, body, and tires of a racing vehicle affect the acceleration and speed attainable. The speed control of the car is represented by the model as shown in the following figure.



(i) Calculate the steady state error of the car to a step command in speed. (5 M)

(ii) Calculate the overshoot of the speed to a step command. (15 M)

Sol: $G(s) = \frac{100}{(s+2)(s+5)}$, $H(s) = 1$

(i) Steady state error:

$$K_p = \lim_{s \rightarrow 0} s G(s) = \lim_{s \rightarrow 0} \frac{100}{(s+2)(s+5)} = \frac{100}{10} = 10$$

$$e_{ss} = \frac{A}{1+K_p} = \frac{1}{1+10} = \frac{1}{11} \Rightarrow e_{ss} = 0.0909$$

(ii) Overshoot:

$$CLTF = \frac{100}{(s+2)(s+5)+100}$$

$$= \frac{100}{s^2 + 7s + 110}$$

$$= \frac{100}{110} \left[\frac{110}{s^2 + 7s + 110} \right]$$

$$= \frac{10}{11} \left[\frac{110}{s^2 + 7s + 110} \right]$$

$$\omega_n = 10.48 \text{ rad/sec}$$

$$2\xi\omega_n = 7 \Rightarrow \xi = \frac{7}{2 \times 10.48} = 0.334$$

$$M_p = (AK)e^{-\pi\xi/\sqrt{1-\xi^2}} = \left(\frac{10}{11}\right)e^{-\pi \times 0.334/\sqrt{1-(0.334)^2}}$$

$$M_p = 0.2986$$

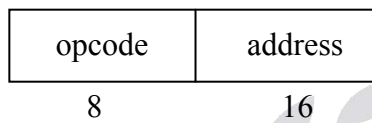
Peak over shoot in percentage

$$\% M_p = 0.334 \times 100 = 33.4\%$$

02. (c) A digital computer has memory capacity of 32767 words with 48 bits per word. The instruction code format consists of 8 bits for the operation part and 16 bits for the address part. Two instructions are packed in one memory word and 48 bit instruction register IR is available in the control unit. Formulate the procedure for fetching and executing the instructions for this computer. (20 M)

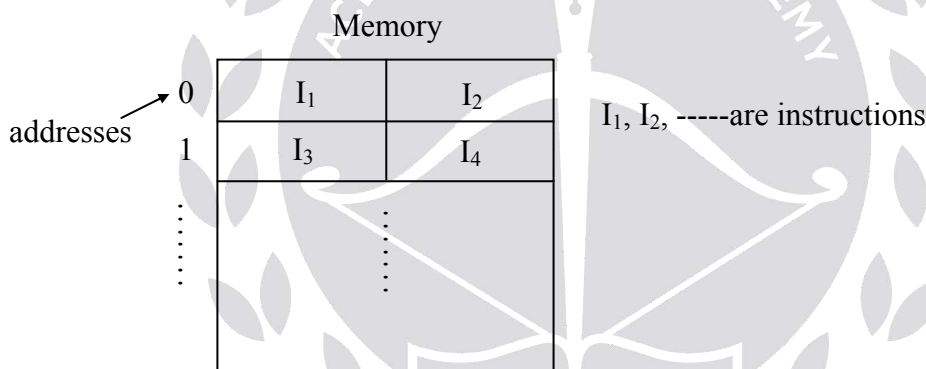
Sol: Memory = 32767×48 -bits

Instruction



Instruction size = $8+16 = 24$ -bits

Assume following storage of instructions in memory



In memory at each address 2-instructions are stored.

Hence in one instruction fetch cycle, 2 instructions are fetched and then these 2-instructions are executed one after another.

So note that for second instruction, there will not be any instruction fetch cycle. The scenario will be good if there is no any branching. But if assume after fetching 2 instructions, first instruction is a branch instruction then one register or any other mechanism is required to keep the other instruction within the CPU; in case of return from branching (function call or interrupt service).

For execution of instructions, hardware is needed to extract one instruction from 48-bit IR and to only execute one instruction.

03. (a) A digital communication system uses five symbols $\{S_0, S_1, S_2, S_3, S_4\}$ with their following probabilities of occurrence

S_0	S_1	S_2	S_3
0.55	0.20	0.10	0.10

(i) Compute Huffman code for these symbols by moving the combined symbol as low as possible. (15 M)

(ii) Calculate the average code word length. (5 M)

Sol:

(i) $S_0 = 0.55$

$S_1 = 0.20$

$S_2 = 0.10$

$S_3 = 0.10$

$S_4 = 1 - [0.55 + 0.2 + 0.1 + 0.1] = 1 - 0.95 = 0.05$

$S_0 = 0.55$

$S_0 = 0.55$

$S_0 = 0.55$

$S_0 = 0.55 (0)$

$S_1 = 0.2$

$S_1 = 0.20$

$S_2S_3S_4 = 0.25 (0)$

$S_1S_2S_3 = 0.45 (1)$

$S_2 = 0.1$

$S_3S_4 = 0.15 (0)$

$S_1 = 0.2 (1)$

$S_3 = 0.1 (0)$

$S_2 = 0.1 (1)$

$S_4 = 0.05 (1)$

$S_0 \quad 0$

$S_1 \quad 11$

$S_2 \quad 101$

$S_3 \quad 1000$

$S_4 \quad 1001$

(ii) $H(X) = - [0.55 \log_2 0.55 + 0.2 \log_2 0.2 + 0.1 \log_2 0.1 + 0.1 \log_2 0.1 + 0.05 \log_2 0.05]$
 $= 0.4743 + 0.46438 + 0.33219 + 0.33219 + 0.21609$
 $= 1.8191$

$\bar{L} = 0.55 \times 1 + 0.2 \times 2 + 0.1 \times 3 + 0.1 \times 4 + 0.05 \times 4 = 1.85$

$\eta = \frac{H(x)}{\bar{L}} = \frac{1.8191}{1.85} = 98.32\%$

03. (b) A unity feedback control system has $KG(s) = \frac{K(s+2)}{s(s+1)}$

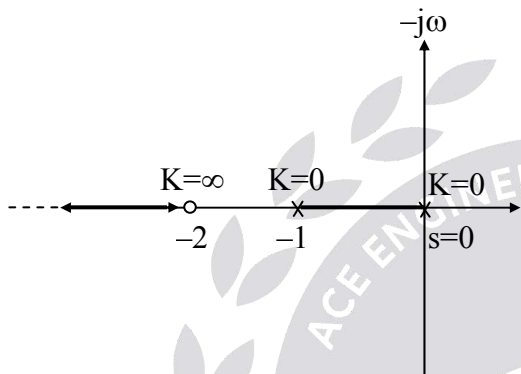
(i) Find the breakaway and entry points on the real axis. (10 M)

(ii) Find the gain and the roots when the real part of the complex roots are located at -2 .

(10 M)

Sol:

(i) $KG(s) = \frac{K(s+2)}{s(s+1)}$



Break points: $\xrightarrow{CE} 1 + KG(s) = 0$

$\xrightarrow{CE} 1 + \frac{K(s+2)}{s(s+1)} = 0$

$\xrightarrow{CE} s^2 + s + K(s+2) = 0$

$K = -\frac{(s^2 + s)}{s+2}$

$\xrightarrow{BP} \frac{dK}{ds} = 0$

$\frac{dK}{ds} = -\left[\frac{(2s+1)(s+2) - (s^2+s)1}{(s+2)^2} \right] = 0$

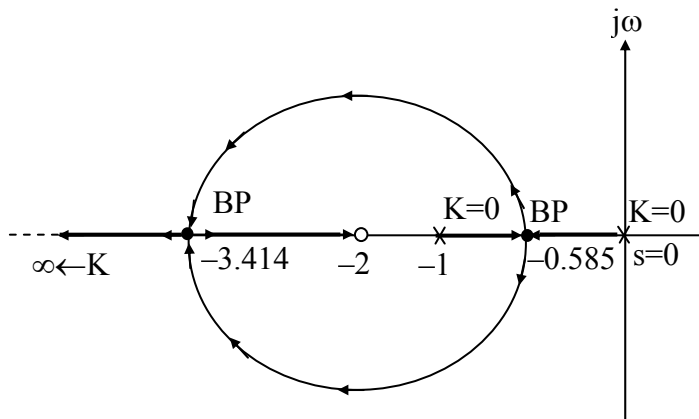
$\Rightarrow 2s^2 + 4s + s + 2 - s^2 - s = 0$

$\Rightarrow s^2 + 4s + 2 = 0$

$\Rightarrow s_1, s_2 = -0.585, -3.414$

Break away and entry points $\Rightarrow -0.585, -3.414$

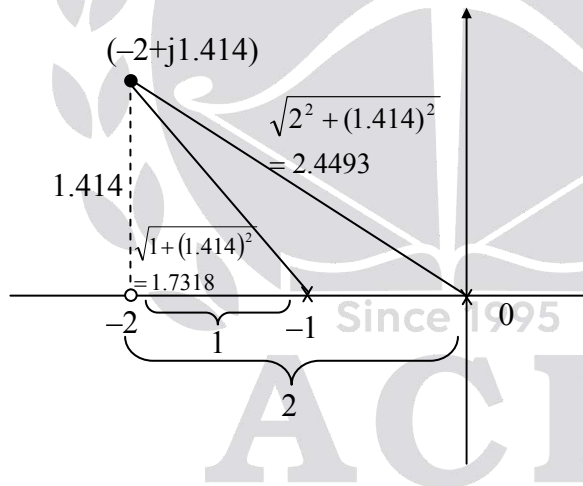
(ii)



⇒ Root locus diagram is circle with radius 1.414 and centre (-2, 0).

K at real part of complex roots at s = -2

Complex poles location is $s = -2 + j1.414$



$$K = \frac{\text{Product of lengths from point to poles}}{\text{Product of lengths from point to zeros}}$$

$$K = \frac{2.4493 \times 1.7318}{1.414} = 2.999 \approx 3$$

03. (c) What is virtual memory? How it is different from main memory? Suppose CPU generates 32 bit virtual addresses and the page size is 16 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 512 page table entries and is 4-way associative. Calculate the size of TLB tag. (20 M)

Sol: A computer can address more memory than the amount physically installed on the system. This extra memory is actually called **virtual memory** and it is a section of a hard disk that's set up to emulate the computer's RAM.

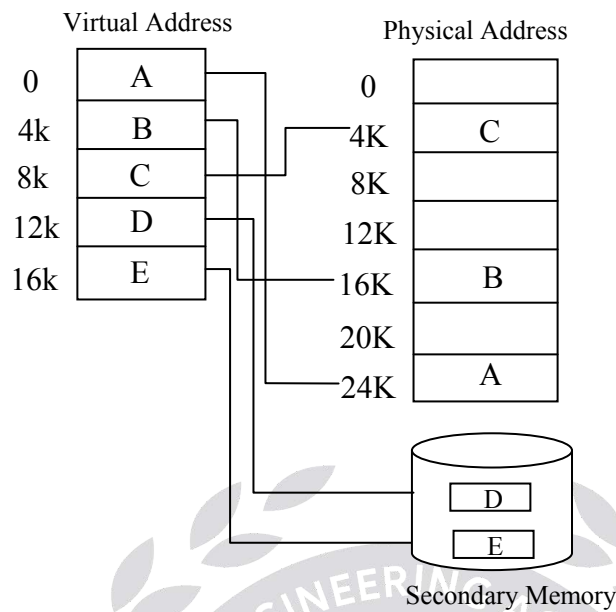
The main visible advantage of this scheme is that programs can be larger than physical memory. Virtual memory serves two purposes. First, it allows us to extend the use of physical memory by using disk. Second, it allows us to have memory protection, because each virtual address is translated to a physical address.

Following are the situations, when entire program is not required to be loaded fully in main memory.

- User written error handling routines are used only when an error occurred in the data or computation.
- Certain options and features of a program may be used rarely.
- Many tables are assigned a fixed amount of address space even though only a small amount of the table is actually used.
- The ability to execute a program that is only partially in memory would counter many benefits.
- Less number of I/O would be needed to load or swap each user program into memory.
- A program would no longer be constrained by the amount of physical memory that is available.
- Each user program could take less physical memory, more programs could be run at the same time, with a corresponding increase in CPU utilization and throughput.

Modern microprocessors intended for general-purpose use, a memory management unit, or MMU, is built into the hardware. The MMU's job is to translate virtual addresses into physical addresses.

A basic example is given below



Virtual memory is commonly implemented by demand paging. It can also be implemented in a segmentation system. Demand segmentation can also be used to provide virtual memory.

Virtual memory:

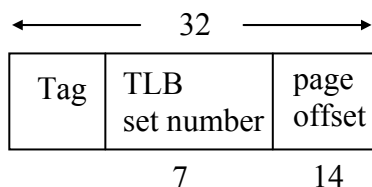
Virtual address = 32-bits

Page size = 16KB = 2^{14} B \Rightarrow page offset = 14-bits

TLB entries = 512 = 2^9

TLB sets = $\frac{2^9}{4} = 2^7$

Virtual address



Tag = $32 - (7 + 14) = 11$ -bits



ACE[®]
Engineering Academy
Leading Institute for ESE/GATE/PSUs



Hyderabad | Ahmedabad | Pune | Delhi | Bhopal | Bhubaneswar | Bangalore | Patna | Chennai | Lucknow | Visakhapatnam | Vijayawada | Tirupati | Kolkata

@Hyderabad

New Batches for
GENCO / TRANSCO / DISCOMS
@ Hyderabad
ELECTRICAL ENGINEERING

Batch Dates

29th June & 14th July 2019

Duration : **5 to 6 Months** • Timings : **4 to 6 hrs** • Fee : **45000/-** • Venue : **ABIDS**

It's exclusive for Power Generation Corporation & Power Distribution Company's of all states in India

Syllabus Included

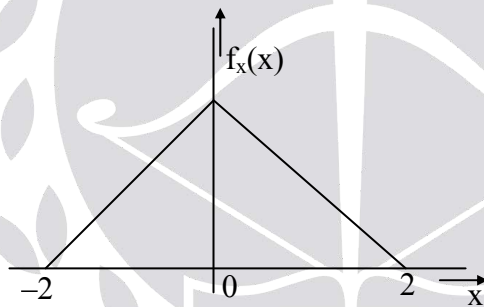
(a). General Aptitude,
(b). Technical Subjects (as per GATE Syllabus Except Mathematics)



Scan QR Code
for More Information

Web: www.aceenggacademy.com | Call: **040-23234418/19/20**

04. (a)

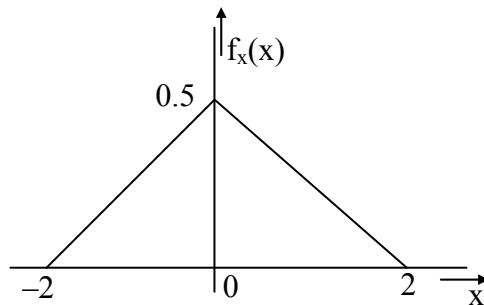


A low pass stationary process $X(t)$ has probability density function (at any given point of time) as shown in the figure. This process has a bandwidth of 5 kHz and is to be transmitted by using a PCM system.

- (i) Calculate the signal to quantization noise ratio (in dBs) if the sampling is done at the Nyquist rate and 5 bit uniform quantizer is used. (8 M)
- (ii) Calculate the bit rate generated. (4 M)
- (iii) If the maximum bit rate supported by the channel is 64 kbps, calculate the possible improvement in signal to quantization noise ratio if the uniform quantizer is redesigned. (8 M)

Sol:

- (i) The pdf of the random process is



$$BW = 5\text{kHz}, \quad n = 5$$

$$\text{Nyquist rate} = 10,000 \text{ samples/sec}$$

$$\text{Sampling rate} = 10,000 \text{ samples/sec}$$

$$\text{Step size} = \Delta = \frac{2 - (-2)}{2^5} = \left(\frac{4}{32}\right) = \frac{1}{8} \text{ V} = 0.125 \text{ V}$$

$$\text{Noise power} = \frac{\Delta^2}{12} = \frac{(0.125)^2}{12} = \frac{16}{2^{10} \times 12}$$

$$\begin{aligned} \text{Signal power} &= \text{mean square value} = \int_{-2}^2 x^2 f(x) dx = \int_{-2}^2 x^2 f(x) dx \\ &= 2 \int_0^2 x^2 [-0.25x + 0.5] dx = \frac{2}{3} \text{ Watts} \end{aligned}$$

$$\text{SNR} = \frac{2}{3} \times \frac{2^{10} \times 12}{16} = 2^9 = 27.09 \text{ dB}$$

- (ii) Bit rate = Sampling rate \times $n = 10,000 \times 5 = 50 \text{ kbps}$

- (iii) For error free transmission

$$C_b \geq R_b$$

$$C_b = 64 \text{ kbps}$$

$$64 \times 10^3 \geq n f_s$$

$$64 \times 10^3 \geq n \times 10 \times 10^3$$

$$n \leq 6.4$$

$$\Rightarrow n = 6 \text{ bits}$$

So, n value increased by 1 bit, hence improvement in signal to Noise ratio is 6dB.

04. (b) A simple unity feedback control system has a process transfer function $G(s) = \frac{K}{s}$.

The system input is a step function with an amplitude A. The initial condition of the system at time t_0 is $y(t_0) = Q$, where $y(t)$ is the output of the system. The performance index of the

system is defined as $I = \int_0^{\infty} e^2(t) dt$ where $e(t)$ is the error in the system response. Show that

performance index I is given as $\frac{(A-Q)^2}{2K}$ where K is gain. (20 M)

Sol: $e(t) = r(t) - y(t)$

At $t = t_0 \Rightarrow e(t_0) = r(t_0) - y(t_0)$

$$= 0 - Q$$

$$e(t_0) = -Q \Rightarrow e(0) = -Q$$

$$E(s) = \frac{R(s)}{1+G(s)} \Rightarrow E(s) = \frac{A/s}{1+K/s}$$

$$E(s) = \frac{A}{s+K}$$

$$sE(s) + KE(s) = A$$

$$\frac{de(t)}{dt} + KE(s) = A$$

$$sE(s) - E(0) + KE(s) = A$$

$$sE(s) + KE(s) = A + E(0)$$

$$E(s) [s+K] = A + E(0)$$

$$E(s) = \frac{A + E(0)}{s+K}$$

ILT

$$e(t) = (A + e(0))e^{-kt}$$

$$e(t) = (A - Q)e^{-kt}$$

$$I = \int_0^{\infty} e^2(t) dt = \int_0^{\infty} (A - Q)^2 e^{-2kt} dt = (A - Q)^2 \left[\frac{e^{-2kt}}{-2k} \right]_0^{\infty} = \frac{(A - Q)^2}{-2k} [e^{-\infty} - e^{-0}]$$

$$I = \frac{(A - Q)^2}{2K}$$

REGULAR BATCHES

GATE+PSUs - 2020

ABIDS DSNR **KOTHAPET KKP**

24th June | 01st July | 08th July | 22nd July |
05th August | 20th August 2019

MPSC MAINS

CIVIL ENGINEERING

REGULAR BATCH: 15th July 2019

FREE ORIENTATION SESSION & DEMO CLASS

06th July 2019, 10am TO 1pm @ PUNE

04. (c) What are the advantages and disadvantages of recursion? Write a code/pseudocode (in any standard programming language) with proper statements to accept a string as a command line argument and hence find its length. (20 M)

Sol: Recursion in C

When a function calls itself from its body is called Recursion.

Advantages

- Reduce unnecessary calling of function.
- Through Recursion one can solve problems in easy way while its iterative solution is very big and complex.

Disadvantages

- Recursive solution is always logical and it is very difficult to trace.(debug and understand).
- In recursive we must have an if statement somewhere to force the function to return without the recursive call being executed, otherwise the function will never return.
- Recursion takes a lot of stack space, usually not considerable when the program is small and running on a PC.
- Recursion uses more processor time.

C program to find length of a string using recursion

```
#include <stdio.h>
int string_length(char*);
int main()
{
    char s[100];
    gets(s);
    printf("Length = %d\n", string_length(s));
    return 0;
}
int string_length(char *s)
{
```

```

static int c = 0;
while (s[c] != '\0')
{
    c++;
    string_length(s+1);
}
return c;
}
    
```

SECTION-B

05. (a) In a system if data is transmitted to remote location using 8 bit PCM encoding, find

- (i) Channel capacity if Bandwidth is 300kHz and SNR = 15 dB. (4 M)
- (ii) The maximum number of channels that can be accommodated in this scheme if Time Division Multiplexing is used with each channel having 5 kHz fixed bandwidth allocation. (6 M)

Sol:

(i) $n = 8$, $B = 300\text{kHz}$, $\text{SNR} = 15\text{dB} = 10^{1.5}$

$$\text{Channel capacity } C = B \log_2 \left[1 + \frac{S}{N} \right] = 300 \times 10^3 \log_2 [1 + 10^{1.5}] = 1508.34 \text{ kbps} = 1.508 \text{ Mbps}$$

- (ii) Bandwidth of the Channel = 300 kHz
 Bandwidth of each signal = 5 kHz

$$\text{Number of channels} = \frac{300 \times 10^3}{5 \times 10^3} = 60 \text{ channels}$$

05. (b) A system is described by the state equations

$$\dot{X} = \begin{bmatrix} 3 & 0 \\ -1 & 1 \end{bmatrix} X + \begin{bmatrix} -1 \\ 1 \end{bmatrix} U \text{ and } Y = [1 \quad 1]X$$

Determine whether the system is controllable and observable.

(10 M)

Sol: $\dot{X} = \begin{bmatrix} 3 & 0 \\ -1 & 1 \end{bmatrix} X + \begin{bmatrix} -1 \\ 1 \end{bmatrix} U, [y] = [1 \ 1] X$

Controllability: $Q_c = [B \ AB]$

$$Q_c = \begin{bmatrix} -1 & -3 \\ 1 & 2 \end{bmatrix} \Rightarrow |Q_c| = -2 + 3 = 1 \neq 0 \text{ controllable.}$$

Observability: $Q_0 = [C^T \ A^T C^T]$

$$[C^T] = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$[A^T] = \begin{bmatrix} 3 & -1 \\ 0 & 1 \end{bmatrix}$$

$$A^T C^T = \begin{bmatrix} 3 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$$Q_0 = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix} \Rightarrow |Q_0| = 1 - 2 = -1 \neq 0 \text{ Observable.}$$

05. (c) An analog cellular system has a total of 33 MHz of bandwidth and uses two 25kHz simplex channels to provide full duplex voice and control channels. What is the number of channels available per cell for a frequency reuse factor of 4 cells ? If 1 MHz is dedicated to a control channel then how many voice channels will be available for reuse factor of 4 cells. (10 M)

Sol: Given:

Total bandwidth = 33MHz

Channel bandwidth = 25 kHz \times 2 simplex channels = 50 kHz/duplex channel

Total available channels = 33000/50 = 660 channels

A 1MHz spectrum for control channels implies that there are 1000/50 = 20 control channels out of the 660 channels available.

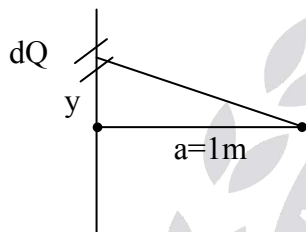
In practice, only the 640 voice channels would be allocated since the control channels are allocated separately as 1 per cell.

Here, the 640 voice channels must be equitable distributed to each cell within the cluster.

For $N = 4$, we can have 5 control channels and 160 voice channels per cell. In practice, however, each cell only needs a single control channels. (The controls have a greater reuse distance than the voice channels). Thus one control channel and 160 voice channels would be assigned to each cell.

05. (d) Find the potential at a point P which is 1m radial distance from the midpoint of a 2m straight line charge of uniform density 10nC/m in air. If this line charge is bent to form an arc of a circle of radius 1m, find the percentage change in potential at the same point P. Give reason for this change. (10 M)

Sol:



$$dV = \frac{KdQ}{\sqrt{a^2 + y^2}} = \frac{K\rho_L dy}{\sqrt{a^2 + y^2}}$$

$$V = K\rho_L \int \frac{dy}{\sqrt{a^2 + y^2}}$$

$$V = K\rho_L \int_{y=-1}^1 \frac{1}{\sqrt{a^2 + y^2}} dy$$

$$V = K\rho_L \cdot \ln \left[y + \sqrt{y^2 + a^2} \right]_{-1}^1$$

$$V = K\rho_L \left[\ln \left[1 + \sqrt{2} \right] - \ln \left[-1 + \sqrt{2} \right] \right]$$

$$V = K\rho_L \ln \left[\frac{\sqrt{2} + 1}{\sqrt{2} - 1} \right]$$

$$= 9 \times 10^9 \times 10 \times 10^{-9} \ln \left[\frac{\sqrt{2} + 1}{\sqrt{2} - 1} \right]$$

$$V = 158.64$$

$$dV = \frac{KdQ}{R} = \frac{K\rho_L R d\theta}{R}$$

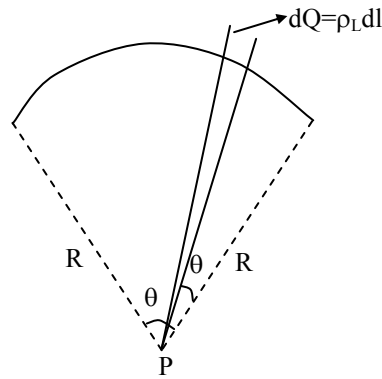
$$V = K\rho_L \int_0^{2\pi} d\theta = k\rho_L (2)$$

$$V = 9 \times 10^9 \times 10 \times 10^{-9} \times 2$$

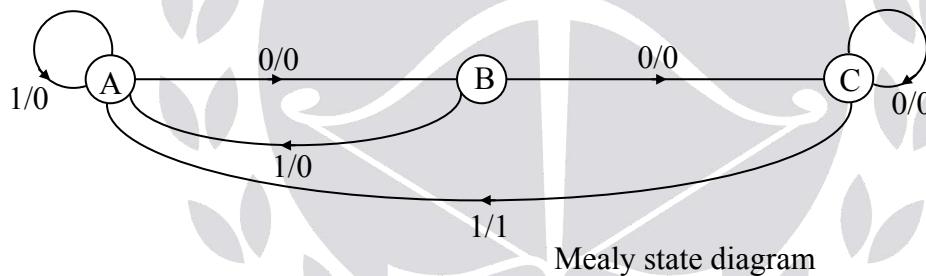
$$V = 180$$

$$\% \text{ of change} = \frac{180 - 158.64}{158.64} \times 100 = 13.46\%$$

In case of a arc the distance from the point to at any point on the arc of charge is same



05. (e)



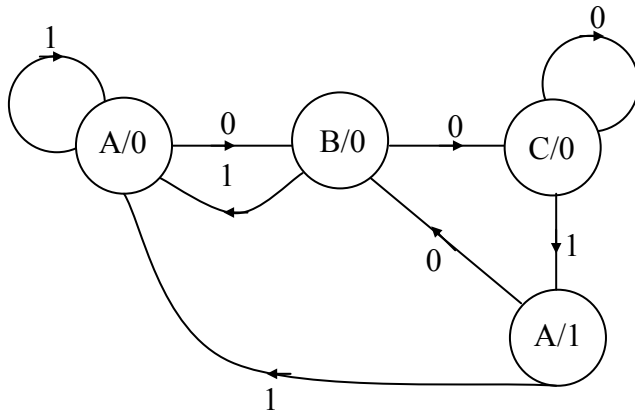
Mealy state diagram

Construct the state diagram for a Moore circuit from the given Mealy circuit. (10 M)

Sol: State Table for given Mealy circuit:

Input (x)	Present state	Next state	output
0	A	B	0
1	A	A	0
0	B	C	0
1	B	A	0
0	C	C	0
1	C	A	1

State Diagram for Moore circuit:



05. (f) A message consists of blocks of 8 bits. A checksum of 8 bits is added after every two blocks. If the first two blocks of a message are:



- (i) Find the checksum bits transmitted. (5 M)**
- (ii) If the channel error causes bits to reverse at the MSB place of both the blocks, find the recovered bit pattern after checksum. (5 M)**

Sol:

(i)

Block 1 -	0011	1010	0010	0101
Block 2 -	0010	0101	0010	0101
Block 1 + Block 2 -	0101	1111		

1's complement of above result is checksum - 1010 0000

(ii) At receiver side, suppose there is no error during transmission then

Block 1 + Block 2 -	0101	1111	1010	0000
	+			
Checksum -	1010	0000	1111	1111

Compliment of above result is 0 0 0 0 0 0 0 0

Which indicates that there is no error

Now since channel caused error in MSB of both the blocks, the received block would be

Block 1 - 1 0 1 1 1 0 1 0

Block 2 - 1 0 1 0 0 1 0 1

$$\begin{array}{r} 0101\ 1111 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ \hline \end{array}$$

$$\begin{array}{r} 0110\ 0000 \\ \hline \end{array}$$

Checksum - 1 0 1 0 0 0 0 0

$$\begin{array}{r} 0000\ 0000 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ \hline \end{array}$$

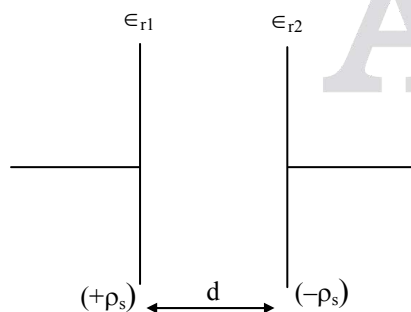
$$\begin{array}{r} 0000\ 0001 \\ \hline \end{array}$$

Compliment above result we have

1 1 1 1 1 1 1 0 is the recovered bit pattern

06. (a) The relative permittivity of a dielectric material between the plates of parallel plate capacitor varies uniformly from $\epsilon_{r1} = 1$ at one plate to $\epsilon_{r2} = 4$ at other plate. The area of each plate is 1 m^2 . Find the capacitance per unit length of this capacitor if $d = 3\text{ mm}$. Derive the equation used. (20 M)

Sol:



$$\epsilon_r = \epsilon_{r1} + \left(\frac{\epsilon_{r2} - \epsilon_{r1}}{d} \right) x$$

$$C = \frac{Q}{V}$$

$$Q = \rho_s A$$

$$V = \int_0^d \bar{E} \cdot d\bar{l}$$

$$V = \int_0^d \frac{\rho_s}{\epsilon_0 \epsilon_r} dx$$

$$V = \frac{\rho_s}{\epsilon_0} \int_0^d \frac{1}{\epsilon_{r1} + \left(\frac{\epsilon_{r2} - \epsilon_{r1}}{d}\right)x} dx$$

$$V = \frac{\rho_s}{\epsilon_0} \frac{\ln \left[\epsilon_{r1} + \left(\frac{\epsilon_{r2} - \epsilon_{r1}}{d}\right)x \right]}{\left(\frac{\epsilon_{r2} - \epsilon_{r1}}{d}\right)} \Bigg|_0^d$$

$$V = \frac{\rho_s d}{\epsilon_0 (\epsilon_{r2} - \epsilon_{r1})} \ln \left(\frac{\epsilon_{r2}}{\epsilon_{r1}} \right)$$

$$C = \frac{Q}{V}$$

$$C = \frac{\rho_s A}{\frac{\rho_s d}{\epsilon_0 (\epsilon_{r2} - \epsilon_{r1})} \ln \left(\frac{\epsilon_{r2}}{\epsilon_{r1}} \right)}$$

$$C = \left(\frac{\epsilon_0 A}{d} \right) \left[\frac{\epsilon_{r2} - \epsilon_{r1}}{\ln \left(\frac{\epsilon_{r2}}{\epsilon_{r1}} \right)} \right] = \frac{8.854 \times 10^{-12} \times 1 \left[\frac{4-1}{\ln(4)} \right]}{3 \times 10^{-3}} = \frac{8.854 \times 10^{-12}}{\ln(4) \times 10^{-3}}$$

$$C = 6.38 \times 10^{-9} \text{ F.}$$

06. (b) (i) Discuss the priority of interrupts of 8086. Draw a circuit that will terminate the INTR when interrupt request has been acknowledged. (15 M)

(ii) Explain Direct Memory Access (DMA) mode of data transfer. (5 M)

SSC-JE (Paper-I)

Online Test Series

Staff Selection Commission - Junior Engineer

No. of Tests : 20

Subject Wise Tests : 16 | Mock Tests - 4

Civil | Electrical | Mechanical

Starts From **10th July 2019**

All tests will be available till 27th September 2019

☎ 040 - 48539866 / 040 - 40136222

✉ testseries@aceenggacademy.com

RRB (JE)-2019

Online Test Series

▶ STAGE - I

Common for all Streams

No. of Tests : 20

Starts from 25th February 2019

▶ STAGE - II

CE | ME | EC | EE

No. of Tests : 20

Starts from 6th May 2019

☎ 040 - 48539866 / 040 - 40136222

✉ testseries@aceenggacademy.com

GATE - 2020

Online Test Series

Starts from 2nd May 2019

No. of Tests : 64

+

Free 52 Practice Tests of
GATE - 2019 Online Test Series

Total Tests : 116

ESE - 2020 PRELIMS

Online Test Series

Starts from 15th May 2019

No. of Tests : 44

+

Free 30 Practice Tests of
ESE - 2019 Online Test Series

Total Tests : 74

GATE+ESE - 2020

Online Test Series

Combination Pack

All tests will be available till
GATE - 2020 & ESE -2020 (Prelims)
examinations respectively.

• Detailed solutions are available.

• Video solutions are also available for difficult questions.

☎ 040 - 48539866 / 040 - 40136222

• All India rank will be given for each test.

• Comparison with all India toppers of ACE students.

✉ testseries@aceenggacademy.com

KPTCL - AE & AEE

Online Test Series

Karnataka Power Transmission Corporation Limited

No. of Tests : 16

Subject Wise Tests : 13 | Mock Tests - 3

Electrical Engineering

Starts From **8th June 2019**

All tests will be available till KPTCL Examination

☎ 040 - 48539866 / 040 - 40136222

✉ testseries@aceenggacademy.com

Sol:

(i) 01. Hard Interrupts:

Hardware interrupts are those interrupts which are caused by any peripheral device by sending a signal through a specific pin to the microprocessor. There are 2 hardware interrupts in 8086 μ p.

(i) NMI (Non Maskable Interrupt):

It is a single pin non maskable hardware interrupt which cannot be disabled. It is the highest priority interrupt in 8086 μ p.

(ii) INTR (Interrupt request):

It provides a single interrupt request and is activated by I/O port. This interrupt can be masked or delayed. It is a level triggered interrupt.

02. Software Interrupts:

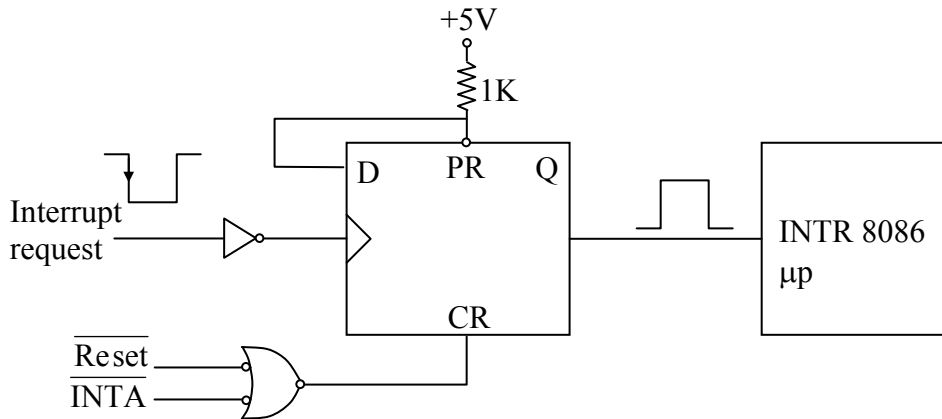
These are instructions that are inserted within the program to generate interrupts. There are 256 software interrupts in 8086 μ p. The address range of interrupt vector table is from 00000H to 003FFH. These are 2 byte instructions. Some of the software interrupts are:

- (i) TYPE 0 corresponds to division by zero.
- (ii) TYPE 1 is used for single step execution for debugging of program.
- (iii) TYPE 2 represents NMI and is used in power failure conditions.
- (iv) TYPE 3 represents a break-point interrupt.
- (v) TYPE 4 is the overflow interrupt.

⇒ As far as the 8086, Interrupt priority are

Interrupt	Priority
Divide Error, Int n, Into	HIGHEST
NMI	↓
INTR	↓
SINGLE STEP	LOWEST

⇒ Termination of INTR Interrupt when request has been acknowledged:



When Interrupt request comes from external devices the falling edge triggers the D-flipflop making the INTR '1'. Then the $\overline{\text{INTA}}$ pulse from μp , resets the flipflop, making INTR to become 0.

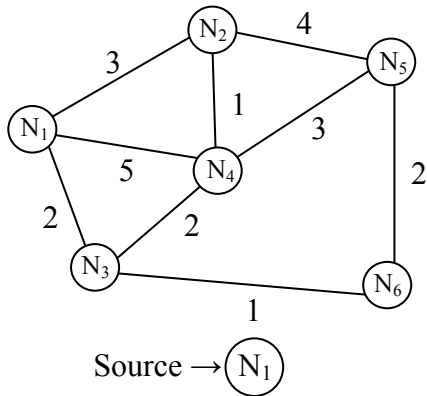
- (ii) Direct Memory Access(DMA) is a method that allows an input/output (I/O) device to send or receive data directly to or from the main memory, bypassing the CPU to speed up memory operations. This process is managed by a chip known as a DMA controller. The data transfer between a fast storage media such as magnetic disk and memory unit is limited by the speed of the CPU. Thus we can allow the peripherals directly communicate with each other using the memory buses, removing the intervention of the CPU. During DMA the CPU is idle and it has no control over the memory buses.

06. (c) A network with 6 nodes with associated cost function is given in the Table below. Calculate the routing table using the shortest path Dijkstra's Algorithm assuming Node 1 as the source node. NC represents no connection between the nodes.

Node Number → ↓	1	2	3	4	5	6
1	–	3	2	5	NC	NC
2	3	–	NC	1	4	NC
3	2	NC	–	2	NC	1
4	5	1	2	–	3	NC
5	NC	4	NC	3	–	2
6	NC	NC	1	NC	2	–

(20 M)

Sol:



Node	Distance	Parent	Visit
N ₁	0		✓
N ₂	∅ 3	N ₁	✓
N ₃	∅ 2	N ₁	✓
N ₄	∅ 5 4	N ₁ N ₃	✓
N ₅	∅ 7 5	N ₂ N ₃	✓
N ₆	∅ 3	N ₃	✓

N₁ Routing Table

Node	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆
Path	N ₁	N ₁ →N ₂	N ₁ →N ₃	N ₁ →N ₃ →N ₄	N ₁ →N ₃ →N ₆ →N ₅	N ₁ →N ₃ →N ₆
Distance	0	3	2	4	5	3

07. (a) A lossless line with $L = 0.5 \mu\text{H/m}$ and $C = 150 \text{ PF/m}$ is operated at a frequency 10 MHz.

Find the shortest length of line at which it acts as

(i) 150 PF Capacitor on an open circuit and short circuit

(ii) 2 μH Inductor on an open circuit and short circuit.

(20 M)

Sol: $Z_0 = \sqrt{\frac{L}{C}}$

$$Z_0 = \sqrt{\frac{5 \times 10^{-7}}{150 \times 10^{-12}}}$$

$$Z_0 = 57.73\Omega$$

$$v_p = \frac{1}{\sqrt{LC}} = 1.15 \times 10^8 \text{ m/sec}$$

$$\lambda = \frac{1.15 \times 10^8}{10^7} = 11.5 \text{ m}$$

(i) 150 pF capacitor

Open circuit:

$$Z_{oc} = -jZ_0 \cot \beta l$$

$$\frac{-j}{\omega C} = -jZ_0 \cot \beta l$$

$$\tan \beta l = \omega C Z_0$$

$$\tan \beta l = 2\pi \times 10^7 \times 150 \times 10^{-12} \times 57.73$$

$$\tan \beta l = 0.544$$

$$\beta l = 28.5^\circ$$

$$l = 28.5^\circ \times \frac{\lambda}{360^\circ}$$

$$l = 0.91 \text{ m}$$

Short circuit:

$$Z_{sc} = jZ_0 \tan \beta l$$

$$jZ_0 \tan \beta l = \frac{-j}{\omega C}$$

$$\tan \beta l = \frac{-1}{\omega C Z_0}$$

$$\tan \beta l = -1.83$$

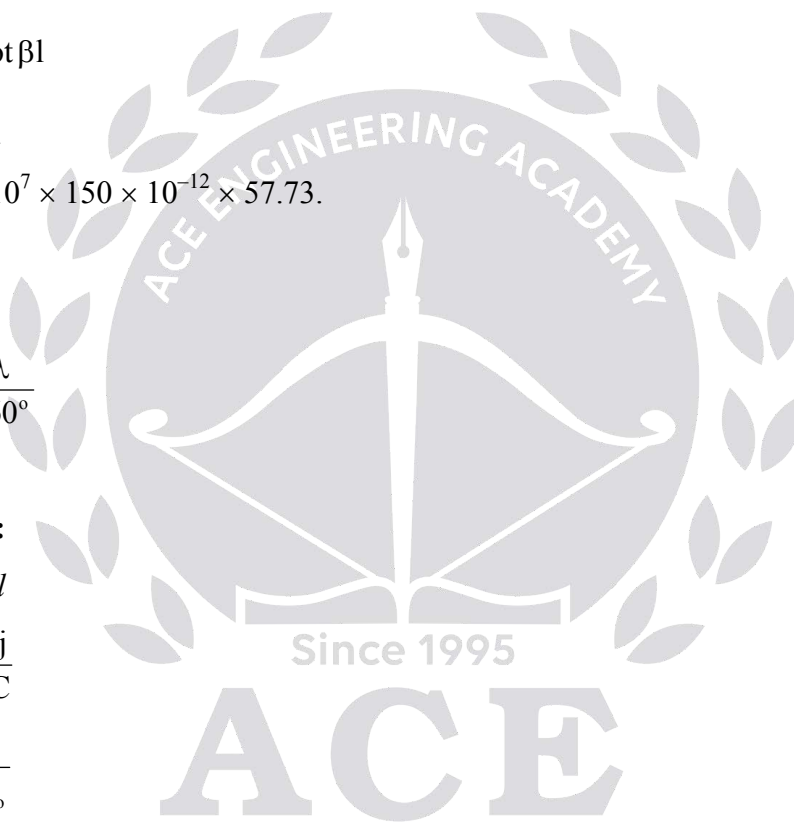
$$\beta l = -61.34^\circ$$

$$l = -61.34^\circ \times \frac{\lambda}{360^\circ}$$

$$l = -1.96$$

$$\text{so, } l = -1.96 + 5.75$$

$$l = 3.79 \text{ m}$$



(ii) $L = 2\mu\text{H}$

Open circuit

$$Z_{oc} = -jZ_o \cot \beta l$$

$$-jZ_o \cot \beta l = j\omega L$$

$$-\frac{Z_o}{\omega L} = \tan \beta l$$

$$\tan \beta l = \frac{-57.73}{2\pi \times 10^7 \times 2 \times 10^{-6}}$$

$$\tan \beta l = -0.459$$

$$\beta l = -24.65^\circ$$

$$l = -0.787\text{m}$$

$$\text{so, } l = 4.96\text{m.}$$

Short circuit:

$$Z_{sc} = jZ_o \tan \beta l$$

$$jZ_o \tan \beta l = j\omega L$$

$$\tan \beta l = \frac{\omega L}{Z_o}$$

$$\tan \beta l = 2.17$$

$$\beta l = 65.25^\circ$$

$$l = 2.08\text{m.}$$



07. (b) (i) Implement the following Boolean function using PLA:

$$\text{Sum}(A, B, C_{in}) = \sum m(1, 2, 4, 7)$$

$$\text{Cout}(A, B, C_{in}) = \sum m(3, 5, 6, 7)$$

(10 M)

(ii) Explain photolithography process. Also, explain the importance of photoresists. (10 M)



ACE

Engineering College

(Approved by AICTE & Affiliated to JNTUH)



Scan for Experts' Advice

@ GHATKESAR, HYDERABAD



B.Tech :

CSE*

IT

ECE*

CIVIL

MECH*

EEE*



Separate Hostel Facility for Boys & Girls

EDC | Guidance for GATE and ESE |
Centre of Excellence in AI / ML, IoT and JHUB

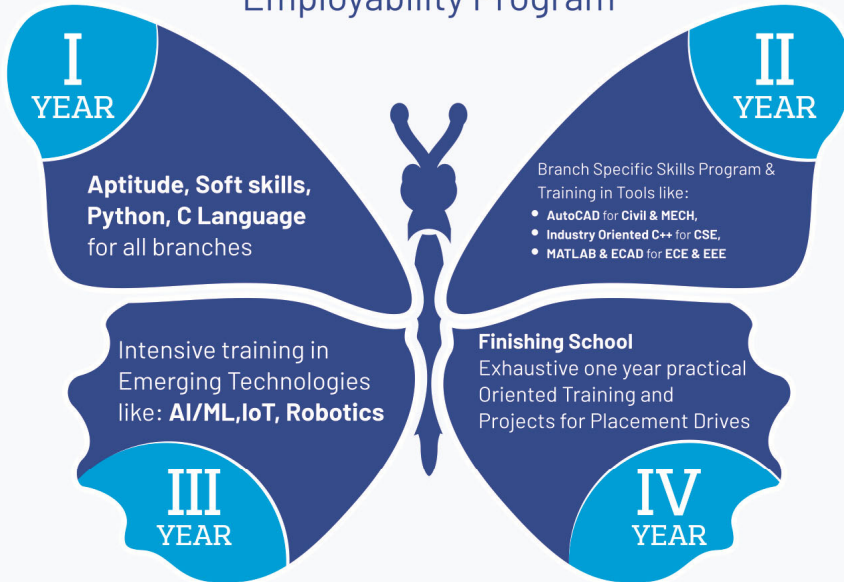


800+ Capacity
Auditorium

Why ACE?

THE BUTTERFLY

Skill Development &
Employability Program



OUR PROMINENT RECRUITERS (A.Y. 2018-19)

INFOSYS	MU SIGMA	VIRTUSA
WIPRO	COGNIZANT	OPENTEXT
TCS	CYIENT	JIO
OPTUM	HITACHI	XTREAMIT
AAIC	AMAZON	HEXAWARE
XIAOMI	HP	GGK TECH
MINDTREE	TECH MAHINDRA	OPTUMRX
MI	CAPGEMINI	CORECOMPETE
SPIDERS	IBM	EPAM
SYNTEL	VALUEMOMENTUM	NINELEAPS

and many more...

More than **80%**

PLACEMENTS

of Registered
Candidates

📞 9133308468, 9912391169, 9133308533

Email: admissions2019@aceec.ac.in | website: www.aceec.ac.in

Sol:

(i) K-Map for sum:

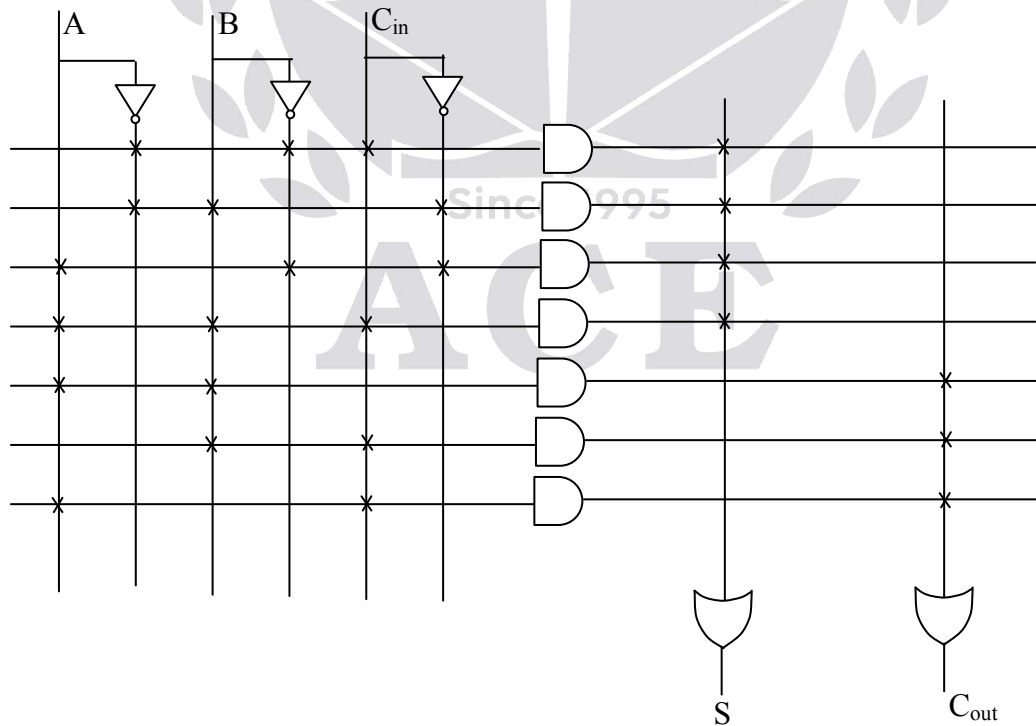
A \ BC _{in}	00	01	11	10
0		1		1
1	1		1	

$$\text{Sum} = \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + A\bar{B}\bar{C}_{in} + ABC_{in}$$

 K-Map for C_{out}:

A \ BC _{in}	00	01	11	10
0			1	
1	1	1	1	

$$C_{out} = AC_{in} + AB + BC_{in}$$

Designing using PLA


(ii) PHOTOLITHOGRAPHY:-

Photolithography is the process of transferring patterns of geometric shapes on a mask to a thin layer of photosensitive material (called photoresist) covering the surface of the semiconductor wafer. These patterns define the various regions in an IC, such as the implantation/diffusion regions, the contact windows, and the bonding pad areas. Pattern transfer is accomplished by an Etching process that selectively removes unmasked portions of a layer.

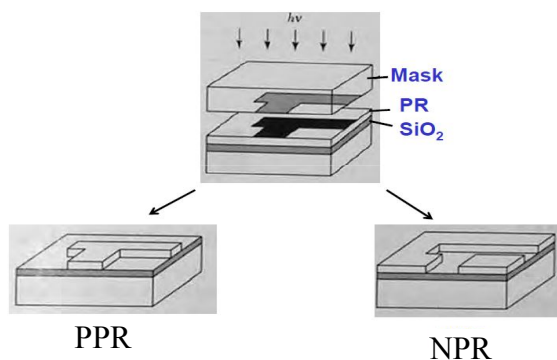
PHOTORESIST:-

Photoresist is a radiation sensitive compound that can be classified as positive or negative, depending on how it responds to radiation.

For positive resists, the exposed regions become more soluble and thus are easily removed in the development process. Prior to exposure, the photoresistive compound is insoluble in the developer solution. After exposure, the photosensitive compound absorbs radiation in the exposed pattern areas, changes its chemical structure and becomes soluble in the developer solution. After development, the exposed areas are removed.

The net result is that the patterns formed (images) in the photoresist are the same as those on the mask.

Negative photoresistive compounds on exposure to light undergo a polymer cross-linking reaction that becomes insoluble in the developer solution. After development the unexposed areas are removed, and the patterns formed in the negative resist are the reverse of the mask pattern.

Pattern Transfer from Mask to PR




www.aceenggacademy.com



ACE

Engineering Academy
Leading Institute for ESE/GATE/PSUs

GATE **48**
All India 1st Ranks

ESE **11**
All India 1st Ranks

LAUNCHING



DIGITAL CLASSES

for **GENERAL STUDIES & ENGINEERING APTITUDE - ESE**

New Batches @ HYDERABAD

GATE+PSUS - 2020

Regular Batches : 24th June, 01st, 08th, 22nd July, 5th & 20th Aug 2019
Spark Batch : 24th June, 2019

ESE+GATE+PSUS - 2020

Spark Batch : 24th June, 2019
Regular Batches : 24th June & 8th July 2019
General Studies Batch : 12th July 2019

GATE+PSUS - 2021

Morning & Evening Batches : 12th July & 10th August 2019

ESE+GATE+PSUS - 2021

Morning Batches : 12th July & 10th August 2019

GENCO / TRANSCO : 29th June 2019

OUR GATE - 2019 TOPPERS

AIR 1 PRAKASH SONCE CE	AIR 1 SIBHARANATHAN PI	AIR 1 RAJAT SONI EC	AIR 1 PRANAV SURESH CSIT	AIR 1 SHASHANK MANDEL IN
AIR 2 KUNAL G EE	AIR 2 MUNISH POODIA EE	AIR 2 ANAND JESU EC	AIR 2 PRITHVIA GOPHA IN	AIR 2 ZENY SILEAM PI
AIR 3 ANANT KOLKARI ME	AIR 3 MANOJ KUMAR CE	AIR 3 SHEKHAR KANWAR EC	AIR 3 PRATEEK AGARWAL CSIT	AIR 3 VIVEK GOUDARAJ IN
AIR 3 SRIJAYAN PI	AIR 3 SRIJAYAN PI	AIR 3 SRIJAYAN PI	AIR 3 SRIJAYAN PI	AIR 3 SRIJAYAN PI

and many more...

TOP 10	TOP 100	TOP 10	TOP 100	TOP 10	TOP 100	TOP 10	TOP 100	TOP 10	TOP 100	TOP 10	TOP 100									
CE	9	74	EE	7	71	EC	5	44	ME	6	60	CSIT	5	28	IN	10	74	PI	10	49

OUR ESE - 2018 TOP RANKERS

AIR 1 SHASHANK E&T	AIR 1 CHIRAG JHA EE	AIR 1 VINAY PRAKASH CE	AIR 1 AMAN JAIN ME
--------------------------	---------------------------	------------------------------	--------------------------

and many more...

TOTAL SELECTIONS : 350 | E&T : 89 | EE : 80 | CE : 92 | ME : 89

HEAD OFFICE

4-1-1236/1/A, Sindhu Sadan, King Koti, Abids, Hyderabad - 500001.

040-23234418, 19, 20, 040-24750437

hyderabad@aceenggacademy.com

www.aceenggacademy.com

DILSUKH NAGAR : 040-40044451, 40209345

KUKATPALLY : 040-40199966, 93476 99966

KOTHAPET : 040 - 24034418/19

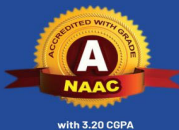


TO WIN THE RACE...
JOIN ACE...



Scan for New Batches

HYDERABAD | AHMEDABAD | DELHI | BHOPAL | PUNE | BHUBANESWAR | LUCKNOW | PATNA | BENGALURU | CHENNAI | VIJAYAWADA | VIZAG | TIRUPATHI | KOLKATA



with 3.20 CGPA



B.Tech Courses*



ACE

Engineering College
(Approved by AICTE & Affiliated to JNTUH)

EAMCET CODE
ACEG

Ghatkesar, Hyderabad | 9133308468, 9912391169, 9133308533 | aceenggcollege@gmail.com | www.aceec.ac.in



Scan QR Code for more details

On-Campus
Hostel Facility
for Boys & Girls



Sponsored by : Yadala Satyanarayana Memorial Educational Society | Powered by : ACE Engineering Academy (Leading Institute for ESE / GATE / PSUs)

COURSES OFFERED

B.Tech (UG)

CSE* 180

ECE* 180

CIVIL 120

MECH* 120

EEE* 60

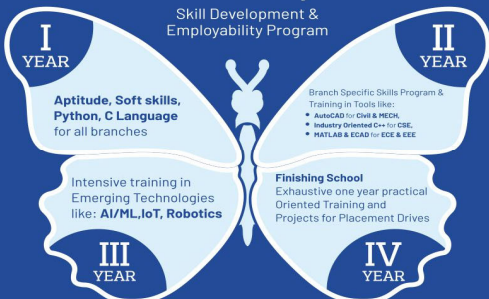
IT** 60

** Subject to Approval of JNTUH

WHY ACE..?

The Butterfly

Skill Development & Employability Program



OUR EMINENT RECRUITERS (A.Y. 2018-19)

- TCS - 21
 - Wipro - 18
 - Amazon - 16
 - Cognizant - 13
 - Cyient - 03
 - Xiaomi - 31
 - Mu Sigma - 01
 - Hitachi - 02
 - A.A.I.C - 05
 - Infosys - 01
 - Optum - 03
- and many more...



INDUSTRY ASSOCIATION WITH

- AICTE-BENNET University
 - Microsoft Innovation Centre
 - TCS-ION Program
 - HCL Technologies Pvt.Ltd.
 - Larsen Toubro (L&T)
 - Cyient
 - Aspiring Minds
 - CoCubes
 - eLitmus
 - TASK
- and many more...

Entrepreneurship Development Cell | Guidance for GATE, GRE, TOEFL, GMAT and CAT

Centre of Excellence in AI / ML, IoT and JHUB | National Service Scheme (NSS)

Department Technical Clubs: • CIVIL-Spacnors • EEE-Phasor • MECH-Mechazaya • ECE-Tektronix • CSE-Cybernetics





ACE
Engineering Academy
Leading Institute for ESE/GATE/PSUs



MPSC (MES) MAINS 2019

(Civil Engineering)

Regular Batch starts on **15th July 2019**

DISCOUNTS AVAILABLE

For ACE students of 2018-19 Session	50%
For ACE students of 2017-18 Session	30%
For ACE students of 2016 earlier	20%

MPSC (MES) MAINS FREE

Orientation & Demo

On 6th July 2019

IES GENERAL STUDIES BATCH

Type of Batch	Timings	Date	Duration	Venue
Weekend Batch	6 to 8 hours of classes Sat: 10am to 7pm & Sun 8am to 6pm	13 th July 2019	4 to 5 Months	@ Pune

83

Ranks in
Top 1000
from **Pune**

121

Ranks in
Top 2000
from **Pune**

153

Ranks in
Top 3000
from **Pune**



ACE
Engineering Academy
Leading Institute for ESE/GATE/PSUs



Hearty Congratulations to our **GATE-2019 TOPPERS**

AIR 1 PRAKHAR SINGH CE	AIR 1 RAJAT SONI EC	AIR 1 PRANAV SHARMA CSIT	AIR 1 SHASHANK MANGAL IN	AIR 1 SURYA NARAYANA PI
--	---	--	--	---

and many more...

GATE-2019 TOPPERS from **Pune Classroom Program**

 SAISH KALASKAR IN-AIR-07	 RANJIT KUMAR ECE-AIR-09	 GAURAV JADHAV ME-AIR-11	 OMKAR LATURE ME-AIR-12	 RUCHA JOSHI ECE-AIR-40	 MANASWINEE THAKUR ECE-AIR-49	 TAHA SHABBIR ME-AIR-52	 SHUBHAM SHUKLA ECE-AIR-72	 OMKAR THORAT ECE-AIR-97	 SHRADDHA PANDEY CSIT-AIR-98
 SAMADHAN BORKAR ME-AIR-104	 K N PRIYAPRASAV PI-AIR-105	 AKASH D SHINDE CE-AIR-106	 S S DESHMUKH XE-AIR-111	 KRISHNA CHAITANYA ME-AIR-133	 VAIBHAV BANAJWADE EE-AIR-140	 ASHUTOSH AGARWAL CE-AIR-147	 ABRUTI A. PANDA ECE-AIR-158	 ADITYA KOLTE IN-AIR-160	 KAGESH PIMPARKAR IN-AIR-171
 B D PRADEEP IN-AIR-222	 SIDHDESH BORSE IN-AIR-229	 SANDESH GAIKWAD ME-AIR-288	 ASHISH K. SHISODE IN-AIR-277	 RIZWAN K.M. ME-AIR-294	 MAYUR VISHE EE-AIR-339	 SHUBHAM DANKONDWAR CSIT-AIR-350	 SHWETA KULKARNI ECE-AIR-444	 AAYUSH CHOUDHARY CSIT-AIR-465	 SAURABH BHAVISKAR ME-AIR-471

and many more...

MPSC (MES) 2018 Qualified Students from Pune

 AJIT WALVE	 BHUSHAN KHANDARE	 PAYAL DIVE	 GANESH PATIL	 GAURAV MALVE	 SUHAS GAVTI	 PANKAJ GOSAVI
 VISHAL KARAD	 VINOD KHADE	 MINAL PAWAR	 NITIN SONWANE	 KUNAL PAKAL	 SHRADDHA KULKARNI	 VANASHRI DHAYTADAK

ESE+GATE +PSUs-2020 Streams: CE/ME/EC/EE	GATE+PSUs 2020 Streams: CE/ME/EC/EE	ESE+GATE +PSUs-2021 (Two Years Integrated program) Streams: CE/ME/EC/EE/IN/CS/IT/PI	83 Ranks in Top 1000 from Pune	121 Ranks in Top 2000 from Pune	153 Ranks in Top 3000 from Pune
--	---	--	---------------------------------------	--	--

Regular Batches Commence 01st July 2019	Regular Batches Commence 1st July 2019 15th July 2019	Weekend Batches Commence 6th July & 17th August 2019	MPSC (MES) MAINS 2019 (Civil Engineering) Regular Batch starts on 15th July 2019 ☎ 020-25535950, 09343499966 🌐 www.aceengacademy.com
--	---	--	--

- 07. (c) (i) Calculate the degradation in the downlink $\left(\frac{C}{I}\right)$ ratio when orbital spacing between the satellites is reduced from 5° to 2° , all the other factors remaining unchanged. Assume antenna characteristics as per Federal Communications Commission (FCC) norms. (10 M)**
- (ii) A low noise amplifier is connected to a receiver which has a noise figure of 12 dB. The power gain of the low noise amplifier is 1000 and its noise temperature referred to the low noise amplifier input. (10 M)**

Sol:

- (i) As per FCC.

$$C/I \text{ degradation} = 25 \log \left(\frac{\phi_i}{\phi_f} \right)$$

$$\phi_i - \text{Initial separation} = 5^\circ, \quad \phi_f - \text{Final separation} = 2^\circ$$

$$\phi_i - \phi_f = 5^\circ - 2^\circ = 3^\circ$$

$$C/I \text{ degradation} = 25 \log \frac{\phi_i}{\phi_f} = 25 \log \frac{5}{2} = 9.94$$

- (ii)



$$\text{Noise Figure} = F = 12 \text{ dB} = 10^{1.2}$$

$$G = 1000$$

$$\text{Noise temperature } T_e = (F - 1) T_0$$

$$T_0 = 290^\circ\text{K}$$

$$T_e = (10^{1.2} - 1) 290^\circ\text{K} = 4306.19^\circ\text{K}$$

- 08. (a) The inside dimensions of 9 GHz air filled waveguide are $2.286 \text{ cm} \times 1.016 \text{ cm}$. Find the maximum power that can be transmitted in the TE mode assuming that the breakdown electric field intensity is $3 \times 10^6 \text{ V/m}$. (20 M)**

Sol:
$$P_{\max} = \frac{1}{4} \frac{E_o^2}{\eta_{\text{TE}_{10}}} (ab)$$

$$f_{\text{TE}_{10}} = \frac{c}{2a} = \frac{3 \times 10^8}{2} \times \frac{1}{2.286 \times 10^{-2}}$$

$$f_{\text{TE}_{10}}^l = 6.5 \text{ GHz}$$

$$\eta_{\text{TE}_{10}} = \frac{\eta}{\sqrt{1 - \left(\frac{f_c}{f}\right)^2}} = \frac{377}{\sqrt{1 - \left(\frac{6.5}{9}\right)^2}} = 545 \Omega$$

$$P_{\text{max}} = \frac{1}{4} \frac{(3 \times 10^6)^2}{545} (2.286 \times 1.016 \times 10^{-4}) = 958.86 \text{ kW.}$$

08. (b) (i) For given discrete time systems, where $y[n]$ and $x[n]$ are the output and the input sequences, respectively. Determine, whether or not the system is linear, causal, stable and time- invariant.

(A) $y[n] = n^2 x[n]$ (B) $y[n] = x[n - 5]$ (10 M)

(ii) Develop two different cascade canonic realization of given causal IIR transfer function (10 M)

$$H(z) = \frac{(0.3 - 0.5z^{-1})(2 + 3.1z^{-1})}{(1 + 2.1z^{-1} - 3z^{-2})(1 + 0.67z^{-1})} \quad (10 \text{ M})$$

Sol:

(i) (A) $y(n) = n^2 x(n)$

$$y_1(n) = n^2 x_1(n)$$

$$y_2(n) = n^2 x_2(n)$$

$$y_3(n) = n^2 [\alpha x_1(n) + \beta x_2(n)] = \alpha y_1(n) + \beta y_2(n)$$

So, linear system.

→ Present output depends on present input. So, causal system

→ For a bounded input, gives unbounded output. So, unstable system.

$$\rightarrow y_1(n) = n^2 x(n - n_0)$$

$$y(n - n_0) = (n - n_0)^2 x(n - n_0)$$

$$y_1(n) \neq y(n - n_0) \text{ so, time vairant}$$

(B) $y(n) = x(n - 5)$

$$\rightarrow y_1(n) = x_1(n - 5)$$

$$y_2(n) = x_2(n - 5)$$

$$y_3(n) = \alpha x_1(n - 5) + \beta x_2(n - 5) = \alpha y_1(n) + \beta y_2(n)$$

so, linear system

→ Present output depends on past inputs. So, it is a causal system.

→ For a bounded input, bounded output produces. So, it is a stable system.

$$\rightarrow y_1(n) = x(n - 5 - n_0)$$

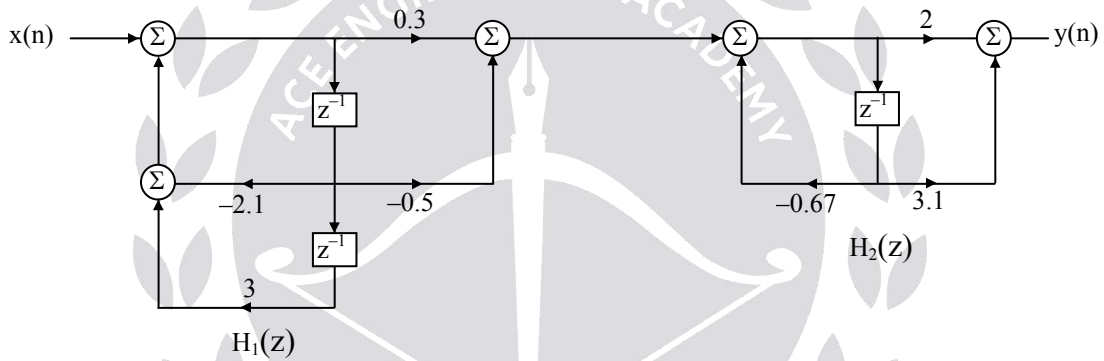
$$y(n - n_0) = x(n - n_0 - 5)$$

$$y_1(n) = y(n - n_0)$$

so, Time invariant.

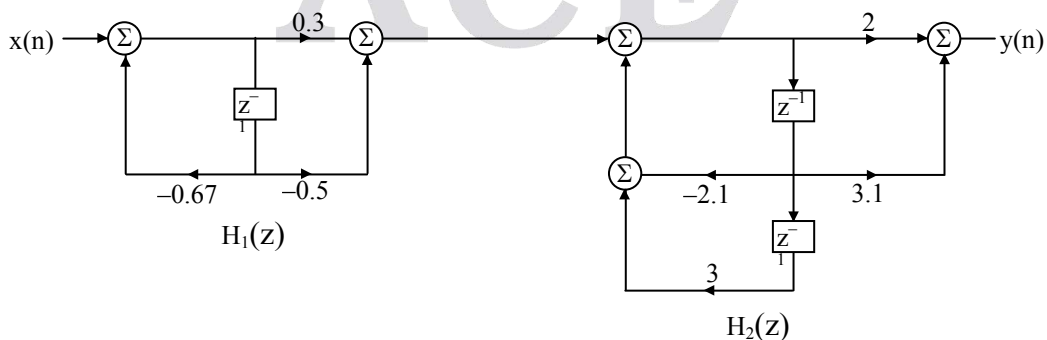
(ii) Technique 1:

$$H_1(z) = \frac{0.3 - 0.5z^{-1}}{1 + 2.1z^{-1} - 3z^{-2}}, H_2(z) = \frac{2 + 3.1z^{-1}}{1 + 0.67z^{-1}}$$



Technique 2:

$$H_1(z) = \frac{0.3 - 0.5z^{-1}}{1 + 0.67z^{-1}}, H_2(z) = \frac{2 + 3.1z^{-1}}{1 + 2.1z^{-1} - 3z^{-2}}$$





ACE

Engineering Academy
Leading Institute for ESE/GATE/PSUs

New Batches @ Bengaluru

Regular Batches For GATE + PSUs – 2020

Type of Batch	Timings	Date	Duration	Venue
Regular Batch	Six Days a Week 6 to 8 Hours Per Day	8 th July 2019	5 to 6 Months	@ Bengaluru

INTEGRATED PROGRAM GATE + PSUs – 2021

Type of Batch	Timings	Date	Duration	Venue
Weekend Batch	Sat 2:30 pm to 7:30 pm Sun 8am to 8pm	3 rd August 2019	14 to 16 Months	@ Bengaluru

KPTCL - AE & AEE **Online** Test Series

Karnataka Power Transmission Corporation Limited

No. of Tests : 16

Subject Wise Tests : 13 | Mock Tests - 3

Electrical Engineering

Starts From **8th June 2019**

All tests will be available till KPTCL Examination

© 040 - 48539866 / 040 - 40136222

✉ testseries@aceenggacademy.com



ACE

Engineering Academy
Leading Institute for ESE/GATE/PSUs



@Kothapet



New Batches @ Hyderabad

Regular Batches For GATE + PSUs – 2020

Type of Batch	Timings	Date	Duration	Streams & Venue
Regular Batch	4 to 6 Hours	8 th July 2019	5 to 6 Months	CS (Abids) CE (Kothapet, Kukatpally) IN, PI (Dilsukhnagar) EC, EE, ME (DSNR, KKP)
		22 nd July 2019		
		05 th August 2019		
		20 th August 2019		

Regular Batches For ESE + GATE + PSUs – 2020

Type of Batch	Timings	Date	Duration	Streams & Venue
Regular Batch	6 to 8 Hours	8 th July 2019	7 to 9 Months	EC, EE (DSNR) ME, CE (Kothapet)

IES GENERAL STUDIES BATCH

Type of Batch	Timings	Date	Duration	Venue
Regular Batch	4 to 6 hours	12 th July 2019	55 to 60 Days	@ Abids

Long Term Program for GATE + PSUs – 2021

Type of Batch	Timings	Date	Duration	Streams & Venue
Morning Batch	6 am to 8 am	12 th July & 10 th August 2019	15 to 16 Months	EC, EE, CE, ME, CSIT & IN @ Abids
Morning Batch	6 am to 8 am	12 th July & 10 th August 2019	15 to 16 Months	EC, EE, ME @ Dilsukhnagar
Evening Batch	6 pm–8.30 Pm	12 th July & 10 th August 2019	15 to 16 Months	EC, EE, ME @ Dilsukhnagar
Morning Batch	6 am to 8 am	12 th July & 10 th August 2019	15 to 16 Months	CE @ Kothapet
Evening Batch	6 pm–8.30 Pm	12 th July & 10 th August 2019	15 to 16 Months	CE @ Kothapet
Morning Batch	6 am to 8 am	12 th July & 10 th August 2019	15 to 16 Months	EC, EE, CE, ME, CSIT & IN @ Kukatpally

MPSC (MES) MAINS 2019 (CE)

Regular Batch starts on **15th July 2019**

08. (c) Describe the mechanism of intermodal dispersion in a multimode step index fiber. Show that the total broadening of a light pulse δT_s , due to intermodal dispersion in a multimode step index fiber may be given as:

$$\delta T_s \approx \frac{L(NA)^2}{2n_1C}$$

Where L is the fiber length, NA is the numerical aperture of the fiber, n_1 is the core refractive index and C is the velocity of light in a vacuum.

(5 + 15 M)

Sol: Multimode Step Index fiber:

Using the ray theory model, the fastest and slowest modes propagating in the step index fiber may be represented by the axial ray and the extreme meridional ray (which is incident at the core-cladding interface at the critical angle ϕ_c) respectively. The paths taken by these two rays in a perfectly structured step index fiber are shown in figure. The delay difference between these two rays when travelling in the fiber core allows estimation of the pulse broadening resulting from intermodal dispersion within the fiber. As both rays are travelling at the same velocity within the constant refractive index fiber core, then the delay difference is directly related to their respective path lengths within the fiber. Hence the time taken for the axial ray to travel along a fiber of length L gives the minimum delay time T_{Min} and:

$$T_{Min} = \frac{\text{distance}}{\text{velocity}} = \frac{L}{(c/n_1)} = \frac{Ln_1}{c} \quad \text{----- (1)}$$

Where n_1 is the refractive index of the core and c is the velocity of light in a vacuum.

The extreme meridional ray exhibits the maximum delay time T_{Max} where:

$$T_{Min} = \frac{L/\cos\theta}{(c/n_1)} = \frac{Ln_1}{c\cos\theta} \quad \text{----- (2)}$$

Using Snell's law of refractive at the core-cladding interface following equation

$$\sin\phi_c = \frac{n_2}{n_1} = \cos\theta \quad \text{----- (3)}$$

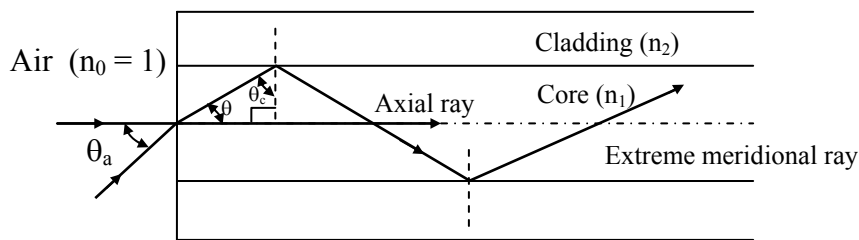


Figure: The paths taken by the axial and an extreme meridional ray in a perfect multimode step index fiber.

Where n_2 is the refractive index of the cladding. Furthermore, substituting into equation for $\cos\theta$ gives:

$$T_{\text{Max}} = \frac{Ln_1^2}{cn_2} \text{ ----- (4)}$$

The delay difference δT_s between the extreme meridional ray and the axial ray may be obtained by subtracting equation (1) from equation (4), Hence:

$$\delta T_s = T_{\text{Max}} - T_{\text{Min}} = \frac{Ln_1^2}{cn_2} - \frac{Ln_1}{c} = \frac{Ln_1^2}{cn_2} \left(\frac{n_1 - n_2}{n_1} \right) \approx \frac{Ln_1^2 \Delta}{cn_2} \text{ when } \Delta \ll 1 \text{ equation (5)}$$

Where Δ is the relative refractive index difference. However, when $\Delta \ll 1$, then from the definition given by equation, the refractive index difference index difference may also be given approximately by:

$$\Delta \approx \frac{n_1 - n_2}{n_2}$$

Hence rearranging equation we get

$$\delta T_s = \frac{Ln_1}{c} \left(\frac{n_1 - n_2}{n_2} \right) \approx \frac{Ln_1 \Delta}{c}$$

Also substituting for Δ from equation gives:

$$\delta T_s \approx \frac{L(\text{NA})^2}{2n_1 c}$$

Where NA is the numerical aperture for the fiber.



Hearty Congratulations to our **GATE-2019 Toppers**

		AIR 1 PRAKHAR SINGH CE	AIR 1 DURYANARAYANA PI	AIR 1 RAJAT SONI EC	AIR 1 PRANAV SHARMA CSIT	AIR 1 SHASHANK MANGAL IN					
AIR 2 VIBHAV SEELAM PI	AIR 2 AMANO JERRY GEORGE EC	AIR 2 PRIYANKA GUPTA IN	AIR 2 KUNAL G EE	AIR 2 MUKESH POONIA EE	AIR 3 ISHU MANOJWALA CE	AIR 3 ANKIT KUSHARI ME	AIR 3 SURBHAM MALVIYA EC	AIR 3 VINAY GOSHWAMI IN	AIR 3 PRATEEK AGARWAL CSIT	AIR 3 ROHIT KHANNA PI	AIR 4 SIDDHARTH WADHWA ME
AIR 4 CHETAN NAVKARWALU EC	AIR 4 CHAITANYA KUMAR EC	AIR 4 ARUNDHAS K IN	AIR 4 RAJ SHRAWAN SINGH IN	AIR 5 CHARMIN PATEL ME	AIR 5 RUTVIK LATHA XE	AIR 5 AYUSH JHAM PI	AIR 5 SAURABH BHATTACHARYA EE	AIR 5 PRANAV KUMAR VERMA EE	AIR 6 RAJ ZUNKE PI	AIR 6 PRIYANSHU SHARMA EC	AIR 6 RAMESH KAMULLA IN
AIR 6 HARI SRIRAVCHI CSIT	AIR 7 CHIRAG RATHI CE	AIR 7 SHREYANS MEHTA CE	AIR 7 AMIT LAL SHAHI PI	AIR 7 ANJU MEENA PI	AIR 7 ANKIT KUMAR EC	AIR 7 SAURABH CHOLETI EC	AIR 7 SAISRI KALASBAR IN	AIR 7 SHWETA YADAV IN	AIR 7 DEEPTHA ROY EE	AIR 7 SHUBHAM MITTAL EE	AIR 9 ATULYA JOTI PI
AIR 9 SANIT KUMAR SINGH EC	AIR 9 DEEP ADVARKY IN	AIR 9 B. SREEKAR IN	AIR 9 ARKA RAY CSIT	AIR 9 RAVI SHANKAR MISHRA CSIT	AIR 10 ASIF KHAN CE	AIR 10 MAHESH TRISH YADAV ME	AIR 10 SHUBHAM PANDE PI	AIR 10 MANOJKUMAR ARORA PI	AIR 10 GARVJIT GURTA XE	AIR 10 GEETHI GEORGE EE	and many more...

Hearty Congratulations to our **ESE-2018 Toppers**

		AIR 1 SHASHANK E&T	AIR 1 CHIRAG JHA EE	AIR 1 VINAY PRAKASH CE	AIR 1 AMAN JAIN ME		
AIR 2 CHERUKURI RAIDEEP E&T	AIR 2 SHADAB AHMAD EE	AIR 2 PUNIT SINGH CE	AIR 2 CHIRAG SINGLA ME	AIR 3 RAMESH KAMULLA E&T	AIR 3 SRUJAN VARMA EE	AIR 3 PRAVEEN KUMAR CE	
AIR 3 MAYUR PATIL ME	AIR 4 JAPJIT SINGH E&T	AIR 4 ANKIT GARG EE	AIR 4 AMIT KUMAR ME	AIR 5 NARINDRA KUMAR E&T	AIR 5 KARTHIK KOTTURU EE	AIR 5 RISHABH DUTT CE	AIR 5 VITHAL PANDEY ME
ESE 2018 TOTAL SELECTIONS		347	E & T TOTAL 89	E TOTAL 78	C TOTAL 88	M TOTAL 89	

& MANY MORE...

48 AIR 1st in **GATE** **11** AIR 1st in **ESE**

Subscribe to our Youtube Channel

www.youtube.com/aceacademyhyd

for Latest Videos on

Preparation Strategy & Tips

for **ESE | GATE | PSUs**



By CMD - ACE

Prof. Y.V. Gopala Krishna Murthy

www.aceenggacademy.com

Contact: **040-23234418,19,20 - 24750437**