(3 Hours) Total Marks: 80

Note: 1) Question no 1 is compulsory.
2) Attempt any 3 question out of remaining.
3) Each question carries 20 Marks.
4) Figures to right indicate full marks.

Q.1 a) Calculate the coefficient of correlation between x and y from the following data: [5]
N=10, $\sum x = 140$, $\sum y = 150$, $\sum(x-10)^2 = 180$, $\sum(y-15)^2 = 215$ and
$\sum(x-10)(y-15) \quad = 60$

b) Evaluate $\oint_c \ logzdz$ where c is the circle with centre at origin and radius 1. [5]

c) Find the projection of $u = (3,0,4)$ along and perpendicular to $v = (2,3,3)$ [5]

d) Find the eigen values of $3A^2 - 2A + 5I$ where $A = \begin{bmatrix} 1 & -2 & 3 \\ 0 & 3 & 2 \\ 0 & 0 & 2 \end{bmatrix}$ [5]

Q.2 a) Find the extremals of $\int_{x_1}^{x_2}(1+x^2y')y'dx$ [6]

b) Using Gram-Schmidt process, transform the basis $\{v_1, v_2, v_3\}$ into orthogonal basis where $v_1 = (1,0,0)$, $v_2 = (3,7,-2)$, $v_3 = (0,4,1)$. [6]

c) Show that $A = \begin{bmatrix} 1 & -6 & -4 \\ 0 & 4 & -2 \\ 0 & -6 & -3 \end{bmatrix}$ is diagonalisable and hence find the transforming matrix and diagonal form of A. [8]

Q.3 a) For a normal variable x, with mean 10 and standard deviation 4, find (i) P(|x-14| < 1) and (ii) P(x ≤ 12) [6]

b) Fit a binomial distribution for the following data [6]

x:	0	1	2	3	4	5	6
Frequency:	5	18	28	12	7	6	4

c) Using Rayleigh-Ritz Method find the solution of $I = \int_0^1(2xy - y^2 - y'^2)dx$ where $0 \le x \le 1$ and y(0)=y(1)=0. [8]

Q.4 a) Find the lines of regression for following data [6]

x:	5	6	7	8	9	10	11
y:	11	14	14	15	12	17	16

b) If $f(\propto) = \oint_c \frac{3z^2-z+5}{z-\propto}dz$ where C is the circle $|z| = 3$ then find f(1), f `(-1), f ``(-i), [6]

c) Check whether the set of pairs of real numbers of the form $(1,u)$ with operations $(1,u)+(1,v) = (1,u+v)$ and $k(1,u) = (1,ku)$ is a vector space. [8]

Q.5 a) Find the value of k such that $f(x) = \begin{cases} k(1-x^2) & 0 < x < 1 \\ 0 & otherwise \end{cases}$ is a probability function and hence find P(0.1 < x < 0.2) and P(x > 0.5) [6]

b) If $A = \begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$ then show that $3.tanA = A.tan3$ [6]

c) Find all possible expansions of $f(z) = \frac{1}{(z-1)(z-2)}$. [8]

Q.6 a) Evaluate $\int_0^{2\pi} \frac{cos3\theta}{5+4cos\theta}d\theta$ using Cauchy Residue Theorem. [6]

b) Show that the matrix $A = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ is non-derogatory. [6]

c) Find the m.g.f. of Poisson's Distribution about origin. Hence find its mean and variance [8]

[Time: 3 Hours] **[Total Marks : 80]**

N.B: 1) Question no. 1 is compulsory.
2) Attempt any three out of the remaining five questions
3) Use suitable data, wherever necessary.

Q1. Solve any four : - 20

A) Compare Moore & Mealy models.

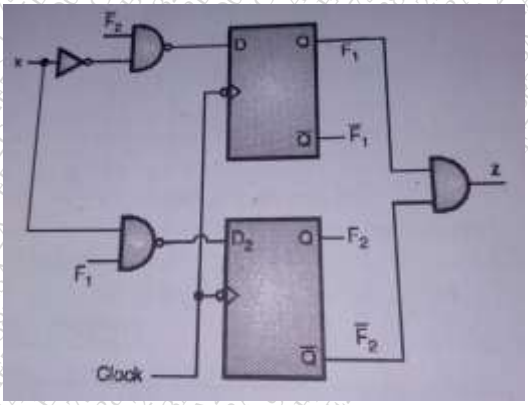
B) State various types of boxes used for drawing the ASM chart.

C) Give classification of RTL operations.

D) Define Clock skew and Metastability.

E) Compose VHDL code for implementation of D Flip Flop.

Q2. A) Analyze the sequential machine shown in figure and obtain the state diagram for the same. 10



B) Draw the data unit for the following RTL description. 10

MODULE : DATA MOVER

MEMORY : A[2]; B[2]; C[2]

INPUT : X[2]

OUTPUT : Z[2]

1. A←X 2. C←A 3. B←C[0], C[1] 4. C← A v B 5. Z=C.

END SEQUENCE.

Q3. A) Shown below is the state table for sequential Machine ,using implication chart method, eliminate redundant and obtain minimized state diagram. 10

Present state	Next State		Output Z	
	X=0	X=1	X=0	X=1
S_0	S_4	S_3	0	1
S_1	S_5	S_3	0	0
S_2	S_4	S_1	0	1
S_3	S_5	S_1	0	0
S_4	S_2	S_5	0	1
S_5	S_1	S_2	0	0

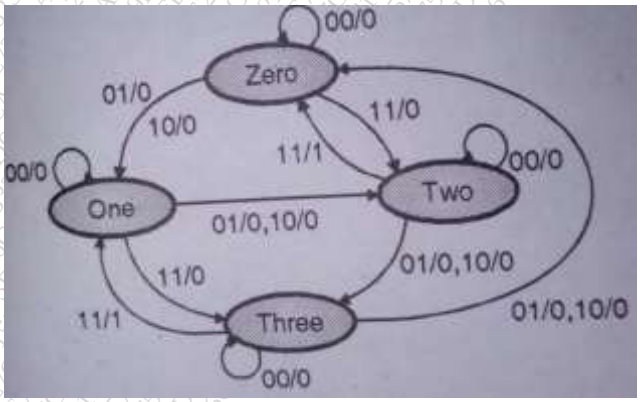
B) Design a sequential circuit using Mealy Machine to detect an overlapping sequence as follows.....1010..... 10

Q4. A) Design MOD 11 synchronous counter usind T Flip Flop . 10

B) Write VHDL code for full adder usind half adder as a component. 10

Q5. A) Draw with logic diagram , a simple 8X4 diode ROM. 10

B) Write a VHDL code for the state diagram shown make use of process statement.



Q6. Write Short Notes on. 20

(i) PLA
(ii) Xilinx XC 9500 CPLD .
(iii) Field programmable gate array (FPGA).
(iv) Various modelling styles in VHDL.

(3 Hours) [Total Marks: 80]

N.B : (1) Question No. 1 is compulsory.
(2) Attempt any three questions from remaining questions.
(3) All questions carry equal marks.

1.a. Explain the conditions under which the pipeline stalls in the 8086. (05)
b. Explain the flag register of the 8086. (05)
c. Explain the advantages of a Superscalar architecture with reference to the Pentium processor. (05)
d. Explain the ICW1 and ICW4 command words of the 8259 PIC. (05)

2. a. Write a detailed note on Interrupt handling in the 8086. (10)
b. Explain the working of a 8086 -8087 system with a neat diagram. (10)

3. a. Explain the generation of the Clock, Ready and reset signals for the 8086 using the 8284 clock generator. (10)
b. Draw and explain the interface of the 8086 to drive a seven segment LED. Write a program to display 0 to 9 continuously. (10)

4. a. Draw and explain the timing diagrams for Read and write operations of the 8086 in Minimum mode. (10)
b. What is Mixed mode programming? Give an example of a mixed mode program using C and assembly language for the 8086. (10)

5. a. Interface 32 KB of ROM (using 16 KB devices) and 32 KB of RAM (using 16KB devices) to the 8086. Draw the memory map and show the address decoding. (10)
b. Explain the Branch Prediction logic of the Pentium. (10)

6. Write short notes on: (Any two) (20)
a. DOS interrupts
b. Instruction and Data Caches of the Pentium
c. Assembler Directives

(3hours) **Total Marks:80**

NB:1. Question number 1 is compulsory

2. attempt any 3 questions from the remaining five questions

3. Assume suitable data wherever needed

Q.1 **Answer any 4 questions**: **(20)**

a) With a neat circuit diagram and waveforms, explain the working of envelope detector. What are its merits and demerits?

b) Explain double spotting. How it can be overcome in AM receivers?

c) Define the following terms with respect to Radio Receivers :
Selectivity , Sensitivity , Fidelity , AGC

d) A single tone FM signal is given by $e_{FM}(t) = 20 \cos(16\pi 10^6 t + 25 \sin 2\pi 10^3 t)$. Find the modulation index, modulating frequency, deviation, carrier frequency and power in the FM signal.

e) What is Coherent detection? Explain the method of Coherent detection of SSB-SC signal.

Q.2 a) An AM signal is produced by modulating a carrier signal with peak voltage of 10V and frequency of 100KHz by a sinusoidal signal of amplitude 4V and frequency 4 kHz . Determine: **(6)**

a) the modulation index and Write its mathematical expression
b) Bandwidth of AM and sketch its two sided spectrum
c) Total power of the modulated wave developed across load resistance, $R_L = 50\ \Omega$ and power content in each sideband and carrier.

b) What are the methods employed for generation of SSB? Explain the third method of SSB generation with its advantages and disadvantages. **(8)**

c) Prove that Balanced modulator circuit (diode based / BJT based) can generate a DSB-SC signal. **(6)**

Q.3 a) Explain the Armstrong method of FM generation. Compare WBFM signal with NBFM signal. **(6)**

b) A modulating signal $15 \cos(2\pi 15 \times 10^3 t)$ angle modulates a carrier $A \cos \omega_c t$. find the modulation index and the bandwidth for FM system. **(8)**
(i) Determine the change in the BW and modulation index for FM , if modulating signal freq is reduced to 5 KHz. Assume Kf = 15 KHz/V.
(ii) find bandwidth and modulation index ,if amplitude is reduced to half.

c) Draw and explain the transmitter and receiver of Linear Delta modulation. What is meant by slope overload distortion? Explain How it can be eliminated? **(6)**

Q.4 a) Explain how Foster- Seelay discriminator can be used for FM detection. List its merits and demerits. **(6)**

b) Draw the functional block diagram of Super-heterodyne receiver with waveforms at the output of each block. Explain the functions of each block. **(8)**

c) What is image frequency and its significance? A super-heterodyne Receiver is tuned to a signal of 1100 KHz frequency with the local oscillator frequency being 1555 KHz? What is the image frequency? What will be the image Frequency rejection ratio when the tuned circuit of mixer stage has a loaded Q of 60? **(6)**

Q.5a) With the help of a neat block diagram explain the generation and detection of a PWM signal. With relevant waveforms, explain how a PPM signal can be generated from a PWM signal. **(10)**

b) State and Prove Sampling theorem for low pass signals. Draw the spectrum of sampled signal for fs > 2W , fs < 2W, fs = 2W. What is Aliasing error? How can you overcome it? **(10)**

Q.6 **Write short notes : any four** **(20)**

a) Block diagram of PCM transmitter and receiver

b) T1 digital carrier system

c) Noise triangle and its significance

d) Block diagram of TRF receiver: its merits and demerits

e) Pre emphasis and de-emphasis circuits.

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Three Hours **80 Marks**

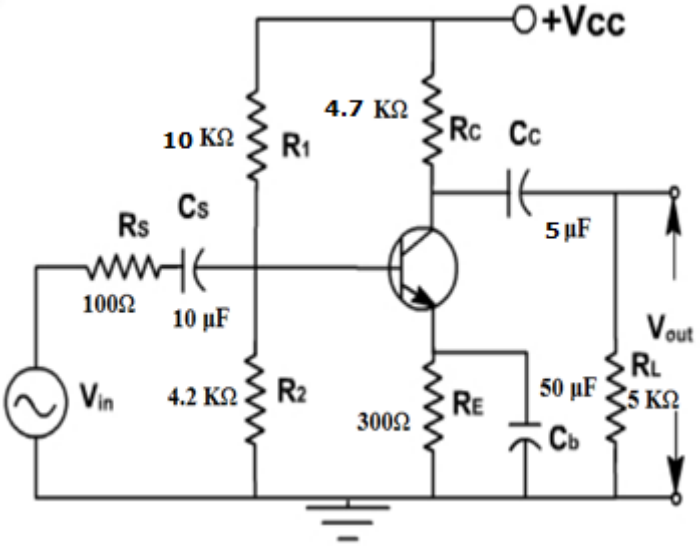
N.B. 1**) Question-1** is compulsory.
2) Solve any **Three** questions from the remaining.
3) Assume suitable data wherever necessary.
4) All questions carry equal marks.

Q.1 Solve any **four** of the following**:** **20**
a) Explain cross over distortion in Class B power amplfier.
b) Explain Darlington pair amplifier.
c) Explain Gunn diode.
d) Explain high frequency equivalent circuit of MOSFET.
e) Draw MOSFET differential amplifier with active load.

Q.2 a) Explain working of TRIAC with construction and V-I characteristics. Also give its applications. **10**
b) Explain voltage series and current shunt feedback amplifiers. **10**

Q.3 a) Calculate lower cut off frequency of the following circuit. **10**

β=100, r_π=1.5KΩ, g_{m2}=50μA/V, C_π=15pF, C_μ=1pF

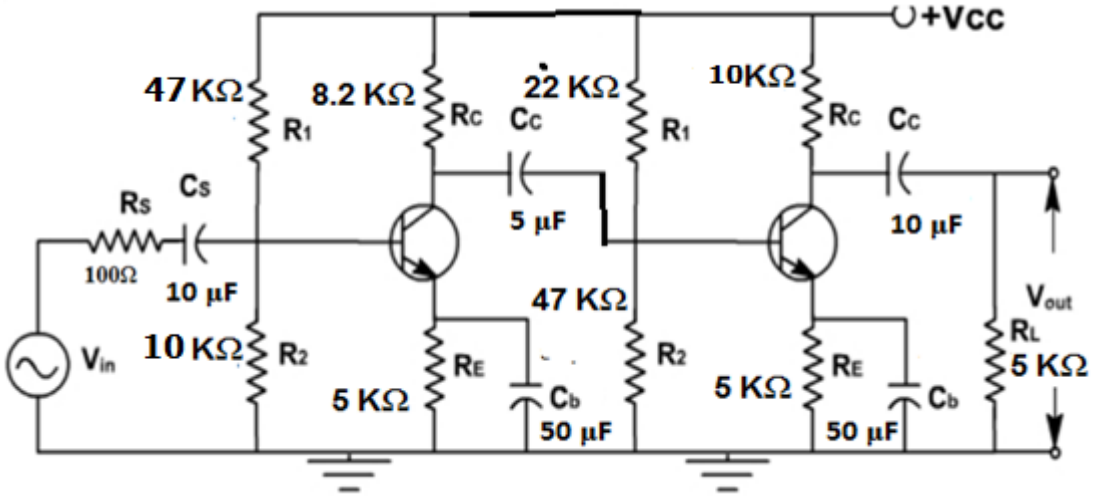


b) Explain UJT as a relaxation oscillator with neat circuit diagram. **10**

Q.4 a) Explain Class A power amplifier with circuit diagram and derive equation for efficiency. **10**
b) Explain small signal analysis for MOSFET active load circuit. **10**

Q.5 a) Calculate bandwidth for two stages RC coupled CE amplifier shown in the circuit below: **10**

$\beta_1 = \beta_2 = 100$, $r_{\pi 1} = r_{\pi 2} = 1.5K\Omega$, $g_{m1} = g_{m2} = 50mA/V$
$C_{\pi 1} = C_{\pi 1} = 10pF$, $C_{\mu 1} = C_{\mu 2} = 5pF$



b) Explain Hartley oscillator. Design the same for 5MHz. **10**

Q.6 Write short notes on any **three** of the following: **20**

a) SCR
b) Wein bridge oscillator.
c) Cascode BJT amplifier
d) Class B push pull power amplifier

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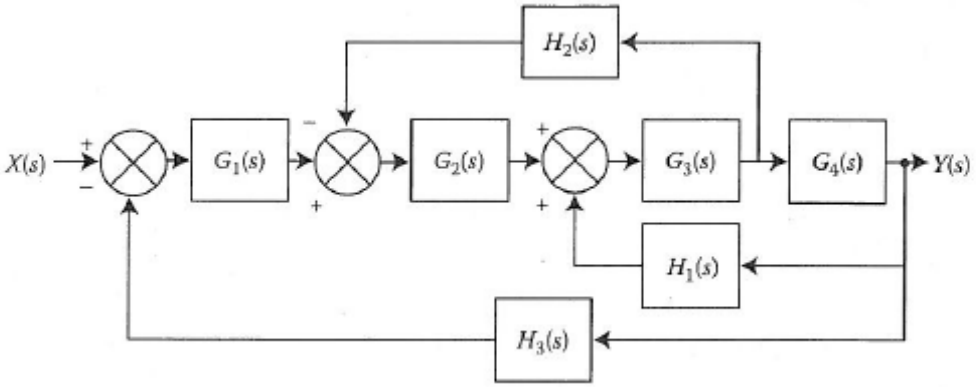
Time: 3 Hours **Marks: 80**

N.B. (1) Question number 1 is compulsory.
(2) Attempt any 3 questions from remaining.
(3) Assume suitable data if required.
(4) Figure to the right indicates full marks.

Q1. Attempt any four questions . **[20]**

a) Explain needs of compensation in control system also explain different types of Compensation with suitable example.
b) What are the properties of state transition matrix?
c) Define Gain margin and Phase margin. Explain how these margins are used for stability analysis
d) Give comparison between open loop and closed loop control systems.
e) Explain the effect of addition of pole and zero to a system.

Q2. A) Find the transfer function C(s)/R(s) of the following system using block diagram technique. **[10]**



Q2. B) Determine breakaway points and break-in points for the characteristics equation given as **[10]**

$$1 + \frac{K(s+2)(s+3)}{s(s+1)} = 0$$

Plot the Root Locus for the system .

Q3. A) Derive an expression for peak time and settling time of an under damped second order system. **[10]**

Q3. B) Obtain the state variable model of the transfer function – **[10]**

$$\frac{Y(s)}{R(s)} = \frac{5s+4}{s^2+4s+3}$$

Q4. A) Apply Kalmans test for checking the controllability of given state equation. [**10]**

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

Q4. B) Ascertain stability of the system whose characteristic equation is **[10]**
s6 + 3s5 + 5s4 + 9s3+ 8s2+ 6s + 4 = 0 . Also find the number of roots lying on the left half, right half and imaginary axis of the s-plane.

Q5. A) Construct the Bode Plot for the following transfer function. Determine the following: **[10]**

i) Gain Margin ii) Phase margin iii) Closed loop stabiity [**10]**

$$G(s)H(s) = \frac{4}{s(s+0.5s)(1+0.08s)}$$

Q5. B) List the performance specifications of Time Response Analysis and derive any four of them. [**10]**

Q6. A) State Adaptive Control System significance in engineering applications [**05]**

Q6. B) Explain PID Controller. [**05]**

Q6. C) Explain the effect of adding a pole to a system on time response. [**05]**

Q6. D) Draw polar plot for the transfer function given by [**05]**

$$G(s) = \frac{8}{s(1+s)}$$