

QP code - 9332

SE Sem - IV R-19 ECS

University of Mumbai
Examinations Summer 2022

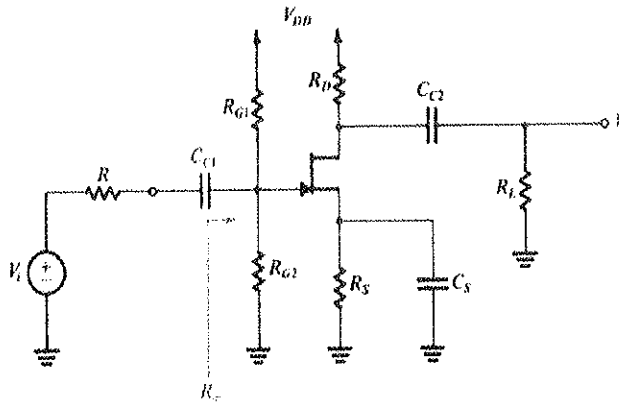
Program No. & Name of the Examination	1T00934 // S.E. (Electronics & Computer Science Engineering) (SEM-IV) (Choice Base Credit Grading System) (R- 19) (C Scheme)
Subject (Paper Code)	40722 // Electronic Circuits

Time:

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks -----20M
1.	Lower cut-off frequency (f_L) depends upon :-
Option A:	Input coupling capacitor only
Option B:	Output coupling capacitor only
Option C:	Bypass coupling capacitor only
Option D:	Combination of input coupling capacitor, output coupling capacitor & bypass capacitor
2.	Differential configuration is preferred over single-ended configuration due to the fact that :-
Option A:	It offers higher voltage gain
Option B:	It eliminates effect of noise to a great extent
Option C:	It is extremely easy to design
Option D:	It can be constructed using fewer components
3.	The speed or rapidity with which output voltage of operational amplifier changes with respect to time is called as :-
Option A:	Slew rate
Option B:	Input offset voltage
Option C:	Output offset voltage
Option D:	Bandwidth
4.	A non-inverting amplifier has $R_2 = 100 \text{ k}\Omega$ & $R_1 = 1 \text{ k}\Omega$. The closed loop voltage gain (with feedback) is:-
Option A:	10
Option B:	101
Option C:	1000
Option D:	1001
5.	What is the minimum required voltage gain to start oscillations in case of a 3 stage RC phase shift oscillator?
Option A:	10
Option B:	3

Option C:	29
Option D:	Depends on component values
6.	Assuming an operational amplifier is working on symmetrical DC power supplies of $+V_{CC}$ & $-V_{EE}$, then as a comparator its output voltage will swing between:-
Option A:	0 V & $+V_{sat}$
Option B:	0 V & $-V_{sat}$
Option C:	$+V_{CC}$ & $-V_{EE}$
Option D:	$\pm V_{sat}$
7.	Which of these circuits are also called as transconductance amplifiers?
Option A:	Voltage to current converter
Option B:	Current to voltage converter
Option C:	Schmitt Trigger
Option D:	Differentiator
8.	What is the time period (T) of a monostable multivibrator using IC 555 Timer?
Option A:	$T = 0.5 \times R \times C$
Option B:	$T = 1.1 \times R \times C$
Option C:	$T = R \times C$
Option D:	$T = 10 \times R \times C$
9.	Which of the following couplings causes a shift of Q – point from one stage to other?
Option A:	RC coupling
Option B:	Impedance coupling
Option C:	Transformer coupling
Option D:	Direct (DC) coupling
10.	Which of these circuits is also called as regenerative comparator?
Option A:	Current to voltage converter
Option B:	Zero crossing detector (ZCD)
Option C:	Schmitt Trigger
Option D:	Differentiator
Q2	Solve any Two Questions out of the Three 10 marks each
A	Draw the circuit diagrams along with input & output waveforms for an operational amplifier-based inverting & non-inverting zero crossing detector (ZCD). also draw the circuit diagram for three input Inverting Summing Amplifier and derive expression for the output.
B	Design a Wien Bridge oscillator to oscillate at an output frequency of $f_o = 500$ Hz. Assume that you have op-amp IC 741C with dual DC power supply of $V_{CC} = +15$ V & $V_{EE} = -15$ V thereby giving $V_{out} = \pm V_{sat} = \pm 13$ V. Draw the neat circuit diagram for the designed circuit.

C	Draw the functional block diagram of the IC 555 timer and explain the various features of the same.
Q3	Solve any Two Questions out of the Three 10 marks each
A	Draw the circuit diagram for the dual input balanced output (DIBO) differential amplifier configuration, Draw the AC equivalent circuits under differential & common mode of operation. Derive appropriate mathematical expressions for differential mode gain (A_d), common mode gain (A_c) & common mode rejection ratio (CMRR)
B	Design IC 555 timer based monostable multivibrator to generate a time delay of $T = 500\text{ms}$ once triggered. Select standard component values. Assume $V_{CC} = +9\text{V}$
C	Explain Barkhausen's criterion for sustained oscillations. Compare 3 stage RC phase shift oscillators & Wien Bridge oscillators on any five points.
Q4	Solve any Two Questions out of the Three 10 marks each
A	For the common source (CS) MOSFET small signal amplifier as shown in Fig. below, determine the lower cut-off frequency (f_L). 
B	Explain the operation of window detector or window comparator with neat sketch (diagram) & appropriate waveforms. Design an inverting Schmitt trigger for upper threshold voltage of $V_{UTP} = +1\text{V}$ & lower threshold voltage of $V_{LTP} = -1\text{V}$. Assume that you have an op-amp IC 741C with dual DC power supply of $V_{CC} = +15\text{V}$ & with $V_{EE} = -15\text{V}$ thereby giving $V_{out} = \pm V_{sat} = \pm 13\text{V}$.
C	For IC 555 timer based astable multivibrator systematically derive all the relevant mathematical expressions for on time period (T_{ON}), off time period (T_{OFF}), total time period (T), frequency (f_0) & duty cycle (D)

DT: 17/05/22

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Examinations Summer 2022

Time: 2hour 30 minutes Max. Marks: 80

E.C.S.

Sub. Engg. Maths IV

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks							
1.	Evaluate $\int_0^{1+i} (x^2 + iy) dz$ along the path $y = x$							
Option A:	$\frac{-1+5i}{6}$							
Option B:	6							
Option C:	-1							
Option D:	0							
2.	The function $f(z) = \frac{z^2}{(z+2)(z-1)^2}$ has							
Option A:	simple pole at $z = -2$ & pole of order 2 at $z = 1$							
Option B:	simple pole at $z = 2$							
Option C:	simple pole at $z = 0$ & pole of order 1 at $z = 2$							
Option D:	simple pole at $z = 0$							
3.	If the line of regression of Y on X is $(Y - 33) = (0.72)(X - 33)$ then the approximate value of Y for $X = 38$ is							
Option A:	20							
Option B:	37							
Option C:	1							
Option D:	10							
4.	If for the non-repeated ranks $\sum D^2 = 8$ & $n = 5$ then the rank correlation coefficient (R) is							
Option A:	0							
Option B:	0.6							
Option C:	7							
Option D:	1							
5.	Find k if pdf of rv X is							
	X	0	1	2	3	4	5	6
	P(X=x)	k	3k	5k	7k	9k	11k	13k
Option A:	1/5							
Option B:	2							
Option C:	1/49							
Option D:	7							
6.	Find E(X) if $f(x) = x$ $0 \leq x \leq 1$							
Option A:	2							
Option B:	1							
Option C:	1/3							
Option D:	0							

7.	If $u=(-2, 3, 4)$ and $v=(3, -2, 3)$ then their dot product is
Option A:	3
Option B:	1
Option C:	2
Option D:	0
8.	If $u=(2,1,0)$ then $\ u\ $
Option A:	$\sqrt{50}$
Option B:	$\sqrt{3}$
Option C:	$\sqrt{5}$
Option D:	1
9.	The matrix form of the Quadratic form $x^2 - 2y^2 + 3z^2 - 4xy + xz - 2yz$ is
Option A:	$[x \ y \ z] \begin{bmatrix} 1 & -2 & 1/2 \\ -2 & -2 & -1 \\ 1/2 & -1 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$
Option B:	$\begin{bmatrix} x \\ y \\ z \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 2 & -2 & -1 \\ 1/2 & 1 & 3 \end{bmatrix}$
Option C:	$\begin{bmatrix} 1 & -2 & 1/2 \\ -2 & -2 & -1 \\ 1/2 & -1 & 3 \end{bmatrix} [x \ y \ z]$
Option D:	$\begin{bmatrix} x \\ y \\ z \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} [x \ y \ z]$
10.	Find the extremals of $\int_{x_1}^{x_2} \frac{y'^2}{x^2} dx$
Option A:	$y=c_1x^5 + c_2$
Option B:	$y=c_1x + c_2$
Option C:	$y=c_1x^3 + c_2$
Option D:	$y=c_1x^6 + c_2$

Q2	Solve any Four out of Six	5 marks each
A	Using residue theorem evaluate $\int_C \frac{3z^2 + z}{z^2 - 1} dz$ where C is the circle $ z = 2$	
B	Fit a straight line to the following data X : 5 6 7 8 9 Y : 2 4 5 6 8	
C	For a normal variate with mean 2.5 and standard deviation 3.5. Find the probability that i) $2 \leq x \leq 4.5$ ii) $-1.5 \leq x \leq 5.5$	
D	Find a unit vector in R^3 orthogonal to both $u = (1, 0, 1)$ and $v = (0, 1, 1)$.	

E	Reduce the quadratic form $6x^2+3y^2+14z^2+4xy+4yz+18xz$ to diagonal form using congruent transformations.
F	Find the extremals of $\int_0^1 (xy + y^2 - 2y^2 y') dx$

Q3	Solve any Four out of Six	5 marks each
A	Evaluate $\int_C \frac{dz}{z^3(z+4)}$ where C is the circle $ z = 2$	
B	Given $6y = 5x + 90$; $15x = 8y + 130$. Find i) \bar{x} and \bar{y} ii) r	
C	Three factories A, B, C produce 30%, 50% and 20 % of the total production of an item. Out of their production 80%, 50% and 10% are defective. An item is chosen at random and found to be defective. Find the probability that it was produced by the factory A.	
D	Construct an orthonormal basis of \mathbb{R}^2 Using Gram-Schmidt process to $S = \{ (3, 1), (2, 3) \}$	
E	Reduce the quadratic form $x^2+2y^2+2z^2-2xy-2yz+xz$ to canonical form. Also find its rank & signature.	
F	Find the extremals of $\int_{x_0}^{x_1} (2xy - y''^2) dx$	

Q4	Solve any Four out of Six	5 marks each
A	Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the regions i) $ z < 1$ ii) $1 < z-1 \leq 2$	
B	Calculate R and r from the following data X : 12 17 22 27 32 Y : 113 119 117 115 121	
C	Fit a poisson distribution to the following data No. of deaths : 0 1 2 3 4 Frequencies : 123 59 14 3 1	
D	Let V be a set of positive real numbers with addition and scalar multiplication defined as $x + y = xy$ and $kx = x^k$ Show that V is a vector space under this addition and scalar multiplication.	
E	Find the singular value decomposition of $\begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$	
F	Using Rayleigh-Ritz method, solve the boundary value problem $\int_0^1 (2xy + y^2 - y'^2) dx$; $0 \leq x \leq 1$ given $y(0) = y(1) = 0$	

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The degree of any vertex of graph is?
Option A:	The number of edges incident with vertex
Option B:	Number of vertex in a graph
Option C:	Number of vertices adjacent to that vertex
Option D:	Number of edges in a graph
2.	Power set of empty or Null set has exactly subset.
Option A:	One
Option B:	Two
Option C:	Three
Option D:	Zero
3.	Determine the partitions of the set $\{3, 4, 5, 6, 7\}$ from the following subsets.
Option A:	$\{3,5\}, \{3,6,7\}, \{4,5,6\}$
Option B:	$\{3,4,6\}, \{7\}$
Option C:	$\{5,6\}, \{5,7\}$
Option D:	$\{3\}, \{4,6\}, \{5\}, \{7\}$
4.	Let A and B be two non-empty relations on a set S. Which of the following statements is false?
Option A:	A and B are transitive $\Rightarrow A \cap B$ is transitive
Option B:	A and B are symmetric $\Rightarrow A \cup B$ is symmetric
Option C:	A and B are transitive $\Rightarrow A \cup B$ is not transitive
Option D:	A and B are reflexive $\Rightarrow A \cap B$ is reflexive
5.	The graph representing universal relation is called
Option A:	complete digraph
Option B:	partial digraph
Option C:	empty graph
Option D:	partial subgraph
6.	A _____ in a graph G is a circuit which consists of every vertex (except first/last vertex) of G exactly once.

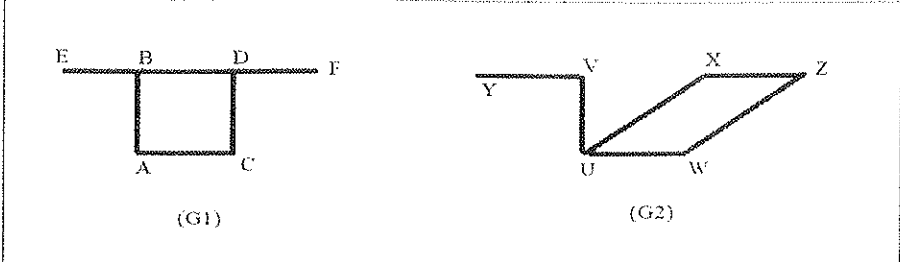
Option A:	Euler path
Option B:	Hamiltonian path
Option C:	Planar graph
Option D:	Path complement graph
7.	In Finite Automata Transition function maps
Option A:	$\Sigma^* Q \rightarrow \Sigma$
Option B:	$Q * \Sigma \rightarrow Q$
Option C:	$Q * Q \rightarrow \Sigma$
Option D:	$\Sigma * \Sigma = Q$
8.	In Moore Machine, the output depends upon?
Option A:	Present State
Option B:	Previous State
Option C:	Present State and Input
Option D:	Only input
9.	Which sentence can be generated by following CFG? $S \rightarrow iCiS \mid iCiSeS \mid a \quad C \rightarrow b$
Option A:	ibbitaea
Option B:	ibtibtaea
Option C:	ibtiiibtea
Option D:	ibtibea
10.	A push down automaton employs _____ data structure.
Option A:	Queue
Option B:	Linked List
Option C:	Hash Table
Option D:	Stack

Please use either of the 3 option given below while setting up the subjective/descriptive questions

Option 1

Q2, Q3 and Q4. (20 Marks Each)	Solve any Four out of Six <i>Please delete the instruction shown in front of every sub question</i>	5 marks each
A	Prove using Mathematical Induction that :- $1+3+5+\dots+(2n-1) = n^2$	
B	Let $A = \{a,b,c\}$. Draw Hasse Diagram for $(p(A), \subseteq)$	
C	Determine the Eulerian path and Hamiltonian path, if exist, in the following graph <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>A)</p> </div> <div style="text-align: center;"> <p>D)</p> </div> </div>	
D	Differentiate DFA and NFA.	
E	Define Regular Expression and give Regular Expression for following language :- (i) Set of all strings that end with 1 and has no substring 00 (ii) Set of all strings on $\{a, b\}$ with even number of a's followed by odd number of b's	
F	Let G be the grammar. Find the leftmost derivation, rightmost derivation and parse tree for the string 'bbaabbaba'. $S \rightarrow aB \mid bA$	

	$A \rightarrow a aS bAA$ $B \rightarrow b bS aBB$ check grammar is ambiguous or not.
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Q3	Solve any Two Questions out of Three	10 marks each
A	Use the laws of logic to show that i) $[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$ is a tautology ii) $\sim(p \vee (\sim p \wedge q))$ and $(\sim p \wedge \sim q)$ are logically equivalent	
B	Let $A = \{1,2,3,4,5\}$, let $R = \{\{1,1\}, \{1,2\}, \{2,1\}, \{2,2\}, \{3,3\}, \{3,4\}, \{4,3\}, \{4,4\}, \{5,5\}\}$ and $S = \{\{1,1\}, \{2,2\}, \{3,3\}, \{4,4\}, \{4,5\}, \{5,4\}, \{5,5\}\}$ be the relations on A. Find the smallest equivalence containing relation R and S.	
C	Determine if following graphs G1 and G2 are isomorphic or not. <div style="text-align: center;">  </div>	

Q4	Solve any Two Questions out of Three	10 marks each
A	Design Mealy machine to change each occurrence of string "baa" by "bab" over $\Sigma = \{a,b\}$.	
B	Convert following context free grammar to equivalent chomsky normal form . $S \rightarrow bA aB$ $A \rightarrow bAA aS a$ $B \rightarrow aBB bS b$	
C	Define PDA and design a PDA to accept an even palindrome over $\{a, b\}$	

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	A control system is said to be open loop, if -
Option A:	The output is independent of input
Option B:	Control action is independent of the input
Option C:	Control action is independent of the output
Option D:	The transfer function of the system is unity
2.	Which of the following is true in the case of an AC servomotor?
Option A:	The fixed winding and control windings are excited by voltages with 180 degrees phase shift
Option B:	The fixed winding and control windings are placed 180 degrees apart in space
Option C:	The fixed winding and control windings are placed 120 degrees apart in space
Option D:	The fixed winding and control windings are placed 90 degrees apart in space
3.	The identical first order system have been cascaded non-interactively. The unit step response of the systems will be:-
Option A:	Under damped
Option B:	Over damped
Option C:	Critically damped
Option D:	Un-damped
4.	The open loop TF of a system is given by: $K/(s - 1)$. The system will be ---
Option A:	Absolutely stable
Option B:	Oscillatory
Option C:	Conditionally Stable
Option D:	Unstable
5.	Which of the following is a time domain specification of a system?
Option A:	Maximum peak overshoot
Option B:	Phase margin
Option C:	Bandwidth
Option D:	Resonant peak
6.	At lower frequencies, the initial slope of the Bode magnitude plot of a type 0 system will be :-
Option A:	-40 dB/decade
Option B:	-20 dB/decade
Option C:	20 dB/decade
Option D:	0 dB/decade
7.	Polar plot of $1/s^2$ will be :-
Option A:	Positive real axis
Option B:	Negative real axis

	Also the No. of oscillations before settles down	
C	What is SCADA? Explain architecture, types and applications	
Q4	Solve any Two Questions	10 marks each
A	For the TF, sketch root locus and comment on stability. $GH(s) = \frac{K}{s(s+3)(s+5)}$	
B	Using Bode plot, find the phase margin and gain margin of the system with TF, $GH(s) = \frac{50}{s(s+5)^2}$	
C	Using Nyquist stability criterion, analyze the stability of a unity feedback system, with TF : $G(s) = \frac{K}{s(T_1s+1)(T_2s+1)}$ for large values of K and small values of K.	

QP code - 93467

ECS

University of Mumbai

Program: **Electronics and Computer Science**

Curriculum Scheme: 2019 'C' Scheme

Examination: SE Semester IV

QP code - 93551

Course Code: ECC 404 and Course Name: Microprocessors and Microcontrollers

Time: 2.5 hours

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which command is used to select the 2 lines and 5*7 matrix of an LCD?
Option A:	0x01
Option B:	0x06
Option C:	0x0e
Option D:	0x38
2.	On power up, the 8051 uses which RAM locations for register R0- R7?
Option A:	00-2F
Option B:	00-07
Option C:	00-7F
Option D:	00-0F
3.	In 8051, which of the ports act as the 16 bit address lines for transferring data through it?
Option A:	PORT 0 and PORT 1
Option B:	PORT 1 and PORT 2
Option C:	PORT 0 and PORT 2
Option D:	PORT 1 and PORT 3
4.	In 8086, as the storing of data words onto the stack is increased, the stack pointer is
Option A:	incremented by 1
Option B:	decremented by 1
Option C:	incremented by 2
Option D:	decremented by 2
5.	Which of the following instruction is not valid?
Option A:	MOV AX, BX
Option B:	MOV DS, 5000H
Option C:	MOV AX, 5000H
Option D:	PUSH AX

6.	When 8051 wakes up then 0x00 is loaded to which register?
Option A:	PSW
Option B:	SP
Option C:	PC
Option D:	A
7.	The directive that directs the assembler to start the memory allotment for a particular segment/block/code from the declared address is)
Option A:	OFFSET
Option B:	LABEL
Option C:	ORG
Option D:	GROUP
8.	What is the advantage of register indirect addressing mode in the 8051?
Option A:	it makes use of registers R0 and R1
Option B:	it uses the data dynamically
Option C:	it makes use of operator @
Option D:	It is simple
9.	In memory-mapped scheme, the devices are viewed as
Option A:	distinct I/O devices
Option B:	memory locations
Option C:	only input devices
Option D:	only output devices
10.	The maximum count value of 16-bit count register puts a limitation on
Option A:	memory usage
Option B:	storage of address of registers
Option C:	to generate clock pulse
Option D:	to generate maximum delay

Q2. (20 Marks)	
A	Solve any Two 5 marks each
i.	Explain the functions of the following pins of the 8086: TEST(Asserted low), READY, MN/MX(Asserted Low)
ii.	Draw and explain the interfacing of a LCD to the 8051.
iii.	Draw and explain interfacing of 8086 in minimum mode with 8259 in cascaded mode.
B	Solve any One 10 marks each
i.	Explain in detail the Dedicated Interrupts of the 8086.
ii.	Write a program to send a character "A" to the serial port at 9600 baud (make necessary assumptions)

Q3. (20 Marks)	
A	Solve any Two 5 marks each
i.	Write a program to transfer block of data (10 bytes) from DS:2000H to ES:2000H using instruction set of 8086 microprocessor.
ii.	Write a program to generate a square wave on Port Pin-2.0 using Timer 0 in Mode 1 in 8051
iii.	List and explain the advantages of memory segmentation in the 8086.
B	Solve any One 10 marks each
i.	Explain the Internal RAM organization of the 8051. Highlight the importance of the Register Banks.
ii.	Write an assembly language program using 8051 to move the stepper motor by 64 degrees in the anti-clockwise direction. Also, draw the interfacing diagram.

Q4. (20 Marks)	
A	Solve any Two 5 marks each
i.	Write a note on the addressing modes of the 8051 with examples of each.
ii.	Explain the BSR mode of the 8255 with one application.
iii.	Explain the generation of the Clock and Reset signals using the 8284 clock generator.
B	Solve any One 10 marks each
i.	Explain the pin structure (with a neat diagram) of any Port 0 pin of the 8051. Also, explain the need for pull-up resistors for Port 0 of 8051 to be output.
ii.	Enumerate the various scenarios when the pipeline of the 8086 may get stalled with examples.