INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
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Saloh, Una (HP) – 177 209
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21205

School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test - II
April 03, 2023

Degree	B. Tech.	**Branch**	ECE
Semester	IV		
Subject Code & Name	ECC401: Microwave Engineering		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Consider an air filled rectangular waveguide with a cross section of 5 cm×3 cm. For this waveguide, find the cut off frequency (in MHz) of TE_{21} mode.	1
1.b	(i) Identify the S-matrices of a perfectly matched, lossless, and non-reciprocal four-port symmetrical and anti-symmetrical circulators. (ii) What is the S-matrix of an ideal two-port isolator that allows power flow in only one direction?	2 (1+1)
1.c	Prove that it is impossible to construct a perfectly matched, lossless, reciprocal three-port junction.	2
2.a	The E field in a rectangular waveguide of inner dimensions $a \times b$ is given by, $E = (\omega\mu/h^2)(\pi/a) H_0 \sin(2\pi x/a) \sin(\omega t - \beta z)\hat{y}$, Where H_0 is a constant, a and b are the dimensions along the x – axis and the y – axis respectively. Find the mode of propagation in the waveguide.	1
2.b	Analytically explain the concept of velocity modulation in a two cavity klystron.	2
2.c	For a rectangular waveguide of internal dimensions $a \times b (a>b)$, the cut – off frequency for the TE_{11} mode is the arithmetic mean of the cut – off frequencies for TE_{10} mode and TE_{20} mode. If $a=\sqrt{5}$ cm, what is the value of b (in cm)?	2
3.a	The modes of rectangular waveguide are denoted by TE_{mn} / TM_{mn} when m and n are Eigen numbers along the larger and smaller dimensions of the waveguide respectively. Identify whether the following statements are true or false and explain the reason. (i) The TE_{11} and TM_{10} are the dominant modes of waveguide. F (ii) The TM_{10} and TE_{10} modes both exist and have same cut off frequency. T	1
3.b	What is the function of the helix in a traveling wave tube (TWT)?	2
3.c	Interpret the resonant modes with equivalent circuit in the operation of magnetron.	2
4.a	Draw at least four valid slow wave structures other than Helical structure.	1
4.b	Explain the concept of modes in reflex klystron oscillator. Identify the mode in which the reflex klystron generates maximum power.	2
4.c	A three-port circulator has an insertion loss of 1 dB and an isolation of -30 dB. Find the S-parameters S_{21} and S_{31}.	2

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AY 2022-23
School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test – II
03, Apr.'23

Degree	B. Tech.	Branch	ECE
Semester	IV		
Subject Code & Name	ECC402 / Control Systems		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Question	Marks
1.a	What is the reason for defining time domain performance measures specifically for step signals in control systems? What would be the implications if ramp signal is used instead?	1
1.b	A mercury thermometer was kept in ice (0°C) for an indefinite period. It was removed and immediately put in boiling water (100°C) and it showed 75°C after 2.5 seconds. Determine the transfer function of the thermometer.	2
1.c	Find the value of the damping ratio, damped and underdamped frequency of the oscillations a closed-loop system is represented by $\frac{d^2c}{dt^2} + 4.8\frac{dc}{dt} = 144e$ where $e = r - 0.5c$ is the actual signal.	2
2.a	Does the presence of an entire row of zeros in the Routh's array always mean that the system has $j\omega$ poles? Justify your answer.	1
2.b	What are the common characteristics of the step responses of second-order underdamped systems as the poles move in the following ways: i. with constant real part; ii. with constant imaginary part; iii. along a radial line extending from the origin?	2
2.c	Given the control system in Figure 1, find the value of K so that there is 10% error in the steady state.	2
3.a	Why are marginally stable systems considered unstable under the BIBO definition of stability?	
3.b	Analytically prove that the time and frequency domain performances are corelated to each other (consider both 1st and 2nd order systems).	

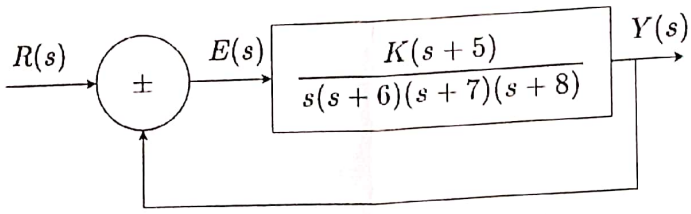
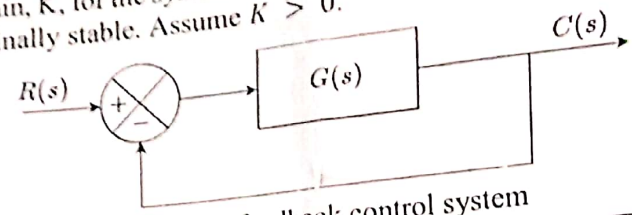


Figure 1: A feedback control system

4.c	In the system shown in Figure 2, let $G(s)$ be $$G(s) = \frac{K}{s(s+7)(s+1)}$$ Find the range of gain, K, for the system as in Figure 2 that will cause the system to be stable, unstable, and marginally stable. Assume $K > 0$.  **Figure 2:** A feedback control system	1
4.a	What are the various advantages of frequency response techniques over the root locus?	2
4.b	Sketch the root locus for the following system: $$G(s) = \frac{1}{s^4 + 4}$$	2
4.c	For each closed-loop system with the following performance characteristics, find the closed-loop bandwidth: i. $\zeta = 0.2$; $T_S = 3$ seconds; ii. $T_S = 4$ seconds; $T_P = 2$ seconds.	

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AY 2022-23
School of Electronics
CURRICULUM: IIITUECE20
Cycle Test – II
05, April'23

Degree	B. Tech.	**Branch**	ECE
Semester	IV		
Subject Code & Name	ECC403: Microprocessors and Microcontrollers		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Find the time delay associated with the loop section of the following DELAY subroutine: DELAY: MOV R3, #100 HERE: NOP NOP NOP DJNZ R3, HERE RET For a crystal frequency of 12MHz.	(1)
1.b	The cost prices of 10 items are stored in RAM locations starting from 50H onwards. When these items are sold out as indicated by a 'high' on a switch, the cost price is replaced by the selling price by adding a constant profit of 19 to each value. This changed data is sent out through port 1 with a delay between each data transfer. Write a program for this scenario.	(2)
1.c	Discuss the register indirect addressing mode with its main limitation. Use this mode to take 10 bytes of data from RAM locations 35H to 44H, add 02 to each of them, and save the result in RAM locations 69H down to 60H.	(2)
2.a	Examine the following code, then answer the following questions: i) Will it jump to NEXT? NO ii) What is in A after the CJNE instruction is executed? MOV A, #55H CJNE A, #99H, NEXT … NEXT: …	(1)
2.b	In a semester, a student has to take six courses. The marks of the student (out of 25) are stored in RAM locations 47H onwards. Write a program to find the average marks, and output it on port 1.	(2)
2.c	Write a program to transfer value 41H serially (one bit at a time) with sending the byte LSB first via pin P2.1. And put two highs at the start and end of the data.	(2)
3.a	Discuss the format of TMOD register.	(1)

3.b	Find the delay generated by Timer 0 in the following code, using both hexadecimal and decimal methods. Do not include the overhead due to instructions.
	CLR P2.3
	MOV TMOD, #01
	HERE: MOV TL0, #3EH
	MOV TH0, #0B8H
	SETB P2.3
	SETB TR0
	AGAIN: JNB TF0, AGAIN
	CLR TR0
	CLR TF0
	CLR P2.3
		(2)

3.c	Generate a square wave with an ON time of 3ms and an OFF time of 10ms on all pins of port 0 by using Timer 0 in Mode 1. Assume an XTAL of 22MHz.	(2)
4.a	Discuss equivalent instructions for the Timer control register (TCON) for starting and stopping the timers/counters.	(1)
4.b	Discuss the different steps to find the values to be loaded into the timer with suitable programming example.	(2)
4.c	Design a counter for counting the pulses of an input signal. The pulses to be counted are fed to pin P3.4 for XTAL = 22MHz.	(2)

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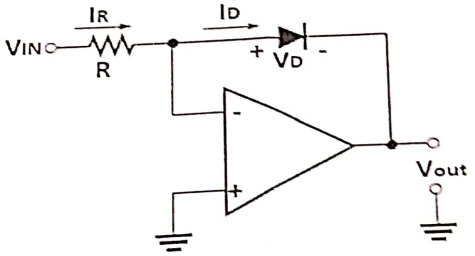
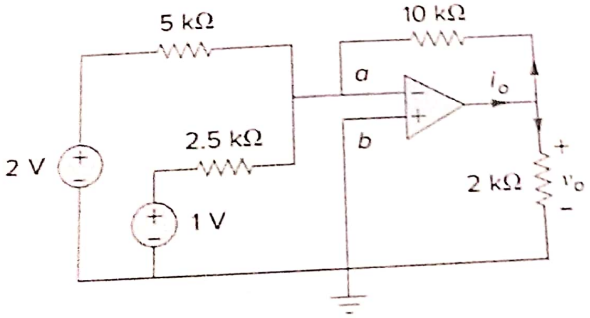
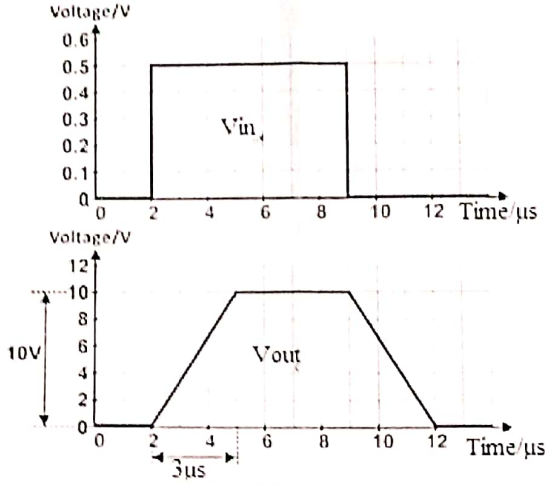
AY 2022-23
School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test – II
05, Apr.'23
Time: 02:00-03:00PM

Degree	B. Tech.	Branch	ECE
Semester	IV		
Subject Code & Name	ECC404: Linear Integrated Circuits		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Question	Marks
1.a	Design a voltage limiter circuit using OP-AMP.	(1)
1.b	Draw the block diagram of multiplier using log and antilog amplifiers. Also, find the expression for output voltage.	(2)
1.c	Determine the output voltage for the circuit shown in Figure 1. Given I_R = 50nA, V_{IN}= 2V and R=100k.  Figure 1	(2)
2.a	Explain the peak detector with the help of circuit diagram.	(1)
2.b	Design a full wave rectifier using OP-AMP for positive cycle and obtain the gain of amplifier.	(2)
2.c	Find v_o and i_o in the OP-AMP circuit given in Figure 2.  Figure 2	(2)
3.a	Define the following terms with respect to filter: I) Cut - off frequency II) Stop and Pass band	(1)

3.b	Why is precision diode preferred? Justify it with mathematical proof for ideal and practical OP-AMP.	(2)
3.c	The Figure 3 shows how an amplifier output responds to a step input signal. Therefore, determine the following: I) Estimate the slew rate for the amplifier. II) Calculate the maximum signal frequency that will produce distortion-free output for a sinusoidal output of amplitude 10V.  Figure 3	(2)
4.a	Calculate the cutoff frequencies for a bandpass filter circuit with $R_1 = R_2 = 10\ k\Omega$, $C_1 = 0.1\ \mu F$, and $C_2 = 0.002\ \mu F$.	(1)
4.b	Discuss the requirement of active filter. Also, determine the voltage gain and cut-off frequencies for the second order filter using Sallen Key method.	(2)
4.c	Design a non-inverting active low pass filter circuit that has a gain of ten at low frequencies, a high cut-off frequency of 159Hz and an input impedance of 10KΩ.	(2)

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